

U. S. DRIVERS AGAINST THE WORLD

POPULAR MECHANICS

★

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

JUNE
25 CENTS

SEE PAGE 840



The Test that Says...



No Acid Here

Even the most super-sensitive test can't find a trace of acid in Quaker State Motor Oil. Quaker State is made only of the finest Pennsylvania crude oil . . . scientifically freed of all impurities in four great, modern refineries. The common ailments of sludge, carbon and corrosion are wholly overcome by *Acid-Free Quaker State*. Your car will run better, last longer. Retail price, 35¢ a quart. Quaker State Oil Refining Corporation, Oil City, Pennsylvania.



NEW TIRE WINS IN SENSATIONAL NON-SKID TESTS!

YOU NEED THIS NEW KIND
OF TIRE IN WET WEATHER
EMERGENCIES LIKE THIS



Stops Quicker, Safer Than Tires Costing up to 70% More!

HERE, at last, is a tire so utterly different in action that, at the first sign of a skid, it turns the wet road under your car into a "dry" surface.

In exhaustive road tests made by the largest independent testing laboratory in the country, against regular and premium-priced tires of America's six largest tire manufacturers, no tire tested, regardless of price, came up to this new tire in non-skid action.

For safety's sake, ride on Goodrich Safety Silvertowns. See your Goodrich dealer or Goodrich Silvertown Store now.

READ THE REPORT— from America's Largest Independent Testing Laboratory

"BOTH regular, and also the premium-priced tires of America's six largest tire manufacturers were submitted to a series of exhaustive road tests made over a three months' period by us, to determine their resistance to skidding and wear, with the following results:

"NON-SKID—The new Goodrich Silvertown with the Life-Saver Tread gave greater skid resistance than any other tire tested, including those tires listed at from 40% to 70% higher in price.

"MILEAGE—The Goodrich Silvertown gave more non-skid mileage than any of the other tires tested in its own price range—averaged 19.1% more miles before the tires wore smooth."

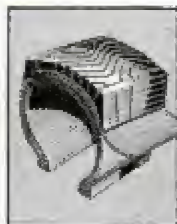


PITTSBURGH TESTING LABORATORY

2 LIFE-SAVING FEATURES . . . AT NO EXTRA COST!



The never-ending spiral bars of the Life-Saver Tread act like a battery of windshield wipers—sweep the water right and left—force it out through the deep grooves . . . give the rubber a dry track to grip.



Don't gamble on blow-outs. Every new Goodrich Safety Silvertown is constructed with the now famous heat-resisting Golden Ply that gives you real protection against high-speed blow-outs.



The new Goodrich SAFETY Silvertown

SKID PROTECTION OF LIFE-SAVER TREAD ◆◆◆ GOLDEN PLY BLOW-OUT PROTECTION

THE BIGGEST TELEPHONE VALUE FOR YOUR MONEY



Nowhere in the world do people get so much for their telephone money as in America. No other people get so much service and such good service at such low cost.

BELL TELEPHONE SYSTEM



Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

June, 1938

Vol. 69, No. 6

Special Features

| | |
|---|----------|
| Wings for Policemen | 801 |
| Don't Pity the Poor Fish | Coloroto |
| The Latest Movie Thrills | 818 |
| The Advance of Diesel | 826 |
| Brute Force vs. Engineering Skill | 834 |
| Age of the Aerial Monsters | 840 |
| Electric Plants Offer Power to All | 850 |
| Phantom Fleet of the Highway, Part II | 858 |
| American Drivers against the World | 866 |
| Riches from the Air | 872 |
| Nature Photos in Your Back Yard | 882 |
| Dress Up Your Magic Tricks | 890 |

(Continued on next page)

Hunting Thrills for the "Mike"

IF YOU have an unusual job, own a singing mouse, collect sharks' teeth as a hobby or possess any other qualification which sets you apart from your fellows, you are likely to be yanked before a microphone to tell the world about it. For radio constantly is seeking new thrills for your jaded ears and the entire world is being combed to find new material for the "mike." Talking dogs, one-arm paper hangers, flag-pole sitters, performing robots and roller-skating roosters all have provided grist for the radio mill. And what new sound you may hear when you twist your dials tomorrow, even the men who seek and find the thrills don't know. But this continual search for radio variety is an interesting business and the tale of what the searchers find makes interesting reading. The first of two articles on this subject appears in the July issue.

Next Month

LITTLE boys armed with punk used to set off the Fourth of July fireworks, often with tragic results. Today experts, skilled in producing spectacular displays, touch off the pyrotechnic wonders which turn night into beauty. An article next month, illustrated with eight pages of Coloroto pictures, explains how modern fireworks spectacles are produced.

Work for the Big Hook

NO automobile has yet won a right-of-way argument with a train, but plenty of trains have lost it, thereby making more work for the big hook which snakes the wreckage off the track. If you've ever wondered what a helpless engineer thinks about as he watches a reckless motorist racing him to a crossing, you'll want to read "More Jobs for the Big Hook" in the July issue.

Wealth from Waste

ALCHEMISTS of the middle ages brewed strange concoctions of pigeons' blood and lichens in a futile attempt to create riches. Where they failed, modern chemists have succeeded. Today they are using such things as dried blood, chicken feathers, sunflower seeds and sweepings from barber shops to produce crystals worth twice their weight in gold. These crystals are vital to your existence as you'll discover by reading this wonder story next month.

"LET
PYROIL
PUT YOUR CAR IN
SHAPE FOR SPRING AND
SUMMER DRIVING."



MANY A REPAIR DOLLAR IS SAVED THIS WAY

Pyroil is made for the express purpose of keeping engine operation efficient—by eliminating contaminations that foul both new and old car performance. In this way, Pyroil offsets many costly repairs. It saves you dollars of ordinary repair or overhaul expense!

Pyroil keeps out sludge, gum and hard carbon. It prevents combustion acids and corrosion from attacking pistons, valves and bearings, and from causing early wear. These are the things that gradually steal power away.

Pyroil keeps valves and rings from sticking, too. Cuts down friction and overheating. Yet you need only a few inexpensive ounces of Pyroil in gas tank and crankcase at intervals, to do all of this!

Better have your service station salesman give your car a money saving Pyroil treatment, today! Mail Coupon. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 56 Pyroil Bldg., LaCrosse, Wisconsin, U. S. A.



SIMPLY
ADD TO
GAS & OIL

**NOTHING FINER FOR
NON-ABRASIVE NEW
CAR BREAK IN!**

**DISTRIBUTORS:
CHECK AND MAIL
COUPON FOR FRAN-
CHISE FACTS.**

PYROIL COMPANY,
56 Pyroil Bldg., LaCrosse, Wis., U. S. A.

Please send complete Pyroil facts.
☐ Also send details of your plan for Distributors.

Name.....

Address.....

City..... County..... State.....

(Contents—Continued)

AUTOMOTIVE

| | |
|---|-----|
| Light on sun visor aids in reading maps | 823 |
| Safety grip holds car on hoist | 824 |
| Crashproof gas tank for trucks | 831 |
| Highway striper covers twenty-five miles daily | 833 |
| "Wigglebug" saves time in lubrication | 848 |
| Oil leak detector shows condition of bearings | 849 |
| Special soap cleans off dirt and oil | 856 |
| Vacuum truck collects garbage | 856 |
| Bike turned into motorcycle | 865 |
| Skidding trailer helps to build safer tires | 870 |
| Eighteen-pound Diesel engine | 879 |
| Ignition analyzer tests parts in thirty seconds | 886 |
| Cableless tractor hauling bus | 887 |
| Double-piston engine for racing motorcycles | 888 |
| Signal warns of waste and saves gasoline | 894 |
| Aerial bridge on truck reaches street lamp | 895 |
| Wheel chair "coupe" driven by lawnmower engine | 895 |
| "Death at the wheel" photo warns motorists | 896 |

AVIATION

| | |
|---|-----|
| Steel is seventeen per cent of plane's weight | 817 |
| Plane image on dial shows position of wheels | 824 |
| Decoy planes made of matting and reed | 825 |
| Four-crankshaft air engine fast without vibration | 832 |
| Children study bombing plane from chart | 839 |
| Lights in cockpit guide pilot through fog | 855 |
| Plane burning liquid hydrogen could circle earth | 856 |
| Midget radio planes test gunner's accuracy | 857 |
| Air line accidents in U. S. | 862 |
| Flying fortresses set record on long journey | 865 |

CONSTRUCTION

| | |
|--|-----|
| Glass "pool" has windows in floor | 822 |
| Slate and asbestos cutter speeds roofing work | 825 |
| Fast-drying cement sets in two hours | 846 |
| Camera helps road builder project future highway | 854 |
| Automatic strip stops draft under door | 879 |
| Burglarproof window opened and shut by crank | 880 |
| Elevator takes tourists to mountain top | 880 |

FARMS

| | |
|---|-----|
| Planes scatter grass seed after forest fire | 838 |
| Waste pumped from barn to fertilize farm | 839 |
| Baby mules put to bed in farm hospital | 855 |

HOUSEHOLD

| | |
|--|-----|
| Metal stand saves lifting iron | 846 |
| Small capacity humidifier operates automatically | 864 |
| Short waves cook ham | 876 |

PHOTOGRAPHY

| | |
|---|-----|
| "Sight test" wall chart for cameras | 830 |
| Oil pool used in movies for reflection shots | 833 |
| Magnifier permits sharp focusing in enlarging photo | 838 |
| Salesman projects rug pattern on floor | 839 |
| Mercury vapor kit increases photo film speed | 848 |
| "Probability machine" to reduce graininess of film | 863 |
| Aerial camera lens sees details a mile below | 871 |
| Speed camera splits lightning into eleven strokes | 871 |

RADIO AND ELECTRICITY

| | |
|--|-----|
| Radio newspaper system in first tests | 886 |
| Compact push-button receivers in table models | 897 |
| How to build a three-tube radio direction finder | 898 |
| Simplified condenser substitution tester | 900 |
| Practical radio hints | 901 |
| All-purpose portable vacation receiver | 902 |
| Amateur transmitter on "add-a-unit" principle | 902 |
| Five-station safety tuning for auto set | 902 |
| Radio test set fits your pocket | 902 |

SCIENCE AND INDUSTRY

| | |
|---|-----|
| Wildcat drillers use latest methods | 830 |
| Making baseballs and bats is big business | 847 |
| Prism and lens weave weird light patterns | 862 |

SHIPS AND SHIPPING

| | |
|---|-----|
| Firemen wear asbestos suits and oxygen masks | 855 |
| Latest radiophone speeds calls from small craft | 878 |
| Satan is emblem on funnel of steamer | 880 |
| Six-screw liners to be built | 887 |
| New passenger ship for U. S. lines | 889 |

SPORTS

| | |
|---|-----|
| Mechanical batter tests liveliness of balls | 817 |
| Tennis on roller skates requires real skill | 825 |
| Outboard motor has flexible shaft | 864 |
| Shorter travel for firing pin | 878 |

TOOLS

| | |
|---|-----|
| Floor sander has stool attached | 830 |
| "Fountain pen" oil can ejects a tiny drop | 846 |
| Tool beads tubing to provide tighter connection | 848 |
| Low-voltage drill run by auto battery | 863 |

(Continued to page 6A)

"THEY BOLTED ME IN, TURNED ON THE WATER!"



JAMES ELWOOD

"I ordered the fire pulled on the No. 7 boiler as we steamed into port," writes Second Engineer James Elwood of 216 East 19th St., New York.

CARELESS FIREMAN TURNS ROUTINE
TASK INTO NIGHTMARE



"Soon as she was cool, I was in there with my flashlight and chipping hammer looking for the trouble. I must have been too quiet about it, for..."



"I heard the clank of the steel manhole cover slam into place! The fireroom crew thought I was out of the boiler. A rush of water told me they were filling her up again!"

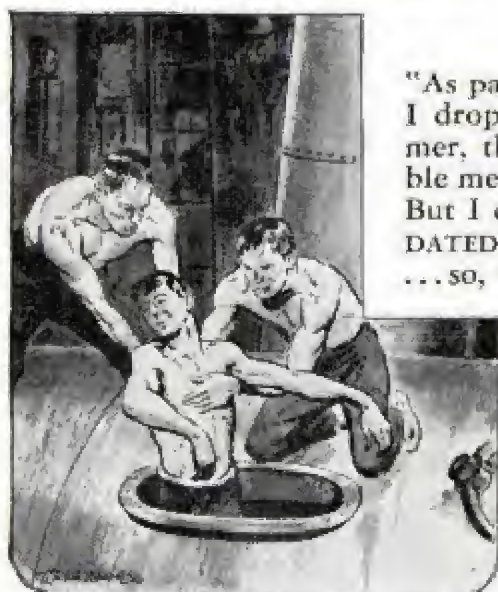


"As panic seized me, I dropped my hammer, the only possible means of being heard out there in the fireroom. But I did hang onto my flashlight and those *fresh* DATED 'Eveready' batteries kept on doing their stuff ... so, when I pulled myself together, I found the hammer and pounded mightily for aid as the water crept higher and higher.

"Yes, they heard me, or I never would have come out of that boiler alive ... so I'm thanking fresh 'Eveready' batteries for being here today.

(SIGNED)

James Elwood



FRESH BATTERIES LAST LONGER... Look for the DATE-LINE

NATIONAL CARBON COMPANY, INC., 30 EAST 42nd STREET, NEW YORK, N. Y.

When writing to advertisers please mention Popular Mechanics

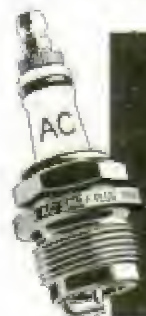


CLEAN PLUGS PEP UP YOUR CAR and save 10% on gas

The statement that dirty spark plugs waste gasoline is based upon fuel consumption tests observed and verified by the Department of Engineering Research of the University of Michigan. The reason why this waste occurs is the fact that dirty plugs misfire intermittently, especially at high speeds and on hard pulls. Dirty plugs behave that way because the dirt (oxide coating) acts as an electrical conductor when hot. Obviously, fuel not ignited is wasted. Misfiring also steals engine power, and causes hard starting. So, in the interests of economy and of engine performance, it is good practice to have your spark plugs cleaned every 4,000 miles and to replace those that are badly worn. There are 70,000 Registered AC Cleaning Stations waiting to serve you. Their charge is only 5c a plug.



Look for this
SIGN
When you need plugs
or plug service.



REPLACE PLUGS
THAT ARE WORN
WITH AC
QUALITY
SPARK PLUGS

AC SPARK PLUG DIVISION
General Motors Corporation • FLINT, MICH.

(Contents—Continued)

| | |
|--|-----|
| Transparent oilcan | 864 |
| Double wrench for hub bolts of dual wheels | 880 |
| Hydraulic power for small shops | 894 |

MISCELLANEOUS

| | |
|---|-----|
| Boy's hobby pays way through school | 817 |
| Shooting gallery uses movie of game as target | 823 |
| Streamline locomotive latest on foreign road | 823 |
| Cable car rides above flooded canyon | 824 |
| Hand tool pulls railroad ties | 824 |
| "Death rays" sterilize air, stop mold growth | 831 |
| Homemade bicycle trailer aids newspaper carriers | 832 |
| Lamp giving polarized light | 838 |
| Making navy's big guns calls for precision | 845 |
| Big shoe on auto latest in advertising | 846 |
| Compass mounted on handlebar of bicycle | 848 |
| Humane muzzle for the dog | 849 |
| Science probes secrets of Stradivarius violin | 853 |
| War tanks ineffective against trained troops | 854 |
| Long-burning super-match starts fire easily | 864 |
| Coal heater in trailer converted into oil burner | 871 |
| Emergency lamp burns in a bucket of water | 876 |
| Submarine micro-telescope reveals underwater life | 876 |
| Anti-aircraft gun sprays sky with steel | 877 |
| Giant bearing to support largest telescope | 877 |
| Law violators take lesson from model city | 879 |
| Tagging of sardines solves migration puzzle | 881 |
| Paint container and cover fit spray gun | 886 |
| Stratosphere rocket is latest of thrill rides | 887 |
| Dental patient administers own gas | 888 |
| Locks made non-pickable by special cylinder | 888 |
| Odd restaurant like zeppelin attracts tourists | 889 |
| Dolls from scrap metal latest of hobbies | 896 |
| Meteorites are worth cash to finder | 896 |

Craftsman and Shop Notes

AUTOMOTIVE

| | |
|--|-----|
| Emery stop for sharpening tire-patching knives | 958 |
| False bottom in cupboard to store valuables | 958 |
| Storage batteries dismantled with heat gun | 958 |
| Car lock lubricated with insect-powder blower | 959 |
| Cars parked in garage at an angle | 959 |
| Pinion gear serves as funnel strainer | 959 |
| Three-way tool to lift cylinder heads | 959 |
| Inside door handles removed with aid of washer | 960 |
| Jig to clean piston-ring grooves | 960 |
| Lamp for examining interior of storage battery | 960 |
| Windshield wiper operated by vacuum cleaner | 960 |

BOATS

| | |
|---|-----|
| Adjustable footrest for boat | 920 |
| Rubber holders support oars while fishing | 922 |
| Non-slip covering for boat seat | 924 |
| Before launching your boat—Part II | 931 |
| Outboard motor moved on detachable wheels | 936 |

CAMPING, FISHING, HUNTING

| | |
|--|-----|
| Camper's potlids have removable finger grips | 910 |
| Tin cans protect legs of picnic table | 915 |
| Two ideas for camping trip | 915 |
| Clothespins hold picnic cloth to ground | 922 |
| Emergency dipper from tin can | 930 |
| Emergency vise for fishermen | 940 |
| Springs keep tent taut | 940 |
| Supports for carrying fishing rod in boat | 943 |

ELECTRICAL

| | |
|---|-----|
| Christmas-tree lamps used in railroad signals | 925 |
| Portable alarm unit for icebox drip pan | 942 |
| Automatic signal for filling station | 958 |

FARM

| | |
|--|-----|
| Adjustable ropes to support fruit-tree limbs | 920 |
| Chicken coops made from oil drums | 944 |
| Singletree hooks that hold harness traces | 954 |

FURNITURE

| | |
|--|-----|
| Utility racks for bath room | 903 |
| "Peg-leg" coffee table with drop leaves | 908 |
| Bookcase table and filing cabinet combined | 923 |
| Doors and lids that roll | 941 |

HAND TOOLS

| | |
|---|-----|
| Protecting hand plane on bench | 906 |
| Mallet given soft nose by rubber band | 925 |
| Corner angle improves pocket tape | 928 |
| Hack-sawing large work | 934 |

(Continued to page 8A)



C. E. VETH

Gets SACCO products on the way to customers for less money . . .

How dare you say, "I have no opportunity"

—when men and women, thru the
new home-study training, are mak-
ing records such as these?



B. J. MERTZ

*Not content, he, to re-
main a teacher at low
pay .*

YOU seek a better opportunity to get ahead in business—and you don't want "promises"; you want a definite program for advancement, backed by positive proof that that program *works!*

Listen, then, to these actual experiences—and when you have heard them, tell us, if you can, how you *dare* to say, "I have no opportunity!"

Earns Raises Totalling 324%

Take the case of C. E. Veth, holding a good job as traffic manager. Many a man would have rested content. Not Veth! Not while it was possible to keep right on moving up in his firm—the Smith Agricultural Chemical Co. of Columbus and Indianapolis. Note what Veth did:

"How," he asked himself, "can I get *more* money? What will *make* me worth more to them? I'm already giving them full value in time and hard work. But if only I could . . ."

And then he saw the way! *He would save them so much money that they could easily give him a fine raise yet still be money ahead!*

So, Mr. Veth watched for ways to do it. He found a few. But his knowledge of the possibilities was limited. At length, a day came when he realized that he needed to *know* more before he could *earn* more. That day he sent us just such a coupon as you see on this page!

What happened? In a single year he detected \$10,600 worth of mistakes in charges that his LaSalle training enabled him to correct—to *save* for his firm. Yes, he got his raise. And another. And still others. *324% at latest report to us.*

700% Increase in 7 Years

From teacher in a rural Texas school to foundry Office Manager and Acting Secretary in four years—at a salary *five times* his former one! And in three years more, B. J. Mertz had become Comptroller and a Director in the Buckeye Union Casualty Co. with a *yearly income 700% greater* than when he mailed the LaSalle coupon. Higher accountancy *training* did it for Mr. Mertz—yes, training plus the *backbone* to get out of an ill-paid rut into the "big time."



BERNICE ROACH

*No single diploma
would satisfy when
several would win
bigger success . . .*

Women, Too, Increase Their Success

For instance, Miss Bernice Roach! Already well paid, she nevertheless *doubled* her income, *quickly*—three months after winning her LaSalle diploma and passing her Certified Public Accountant's examination! "A lucky day for me," she says of the day she enrolled for LaSalle accountancy. Yet what she did, others can do—and *are* doing!

Send for These Free Books

You, too, are eager to get ahead? Then you will find it of vital importance to learn more of the success-methods which Veth, Mertz, Miss Roach and many others have employed so profitably.

We have therefore prepared a special 64-page book which outlines these methods in detail. It also points out the big opportunities in the field you are in or wish to enter—shows you how you may fit yourself to *grasp* them!

The coupon brings this book to you without cost or obligation.

Measure your will to succeed by what you do with this coupon—NOW!

LASALLE EXTENSION—Chicago

Dept. 664-R

Chicago

I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked below.

- ☐ Higher Accountancy
- ☐ Business Management
- ☐ Modern Salesmanship
- ☐ Traffic Management
- ☐ Law: Degree of LL. B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Business Correspondence

- ☐ Stenotypy
- ☐ Credit and Collection
- ☐ Correspondence
- ☐ Modern Foremanship
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Business English
- ☐ Effective Speaking
- ☐ Office Management

Name.....

This One

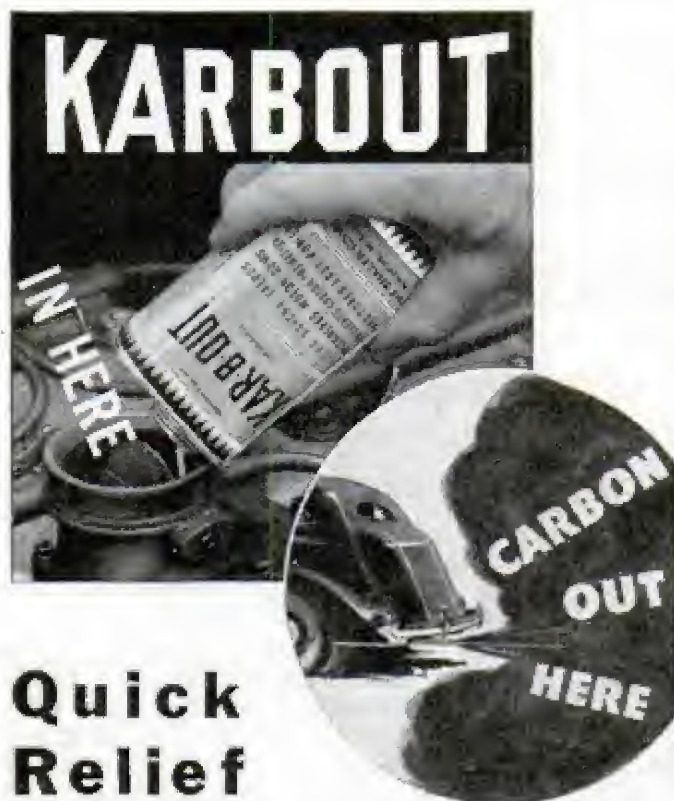
Present Position....

Address.....



6APX-D7N-UFTD

LaSalle Extension Adult
Business Training



Quick Relief Lost Power Restored

KARBOUT dissolves the gums and frees carbon which forms on piston heads, in piston ring grooves and on valve stems—allowing it to pass off with the exhaust.

This concentrated Gum Solvent dissolves all types of motor gums—frees your engine of sticky valves—eliminates carbon formations—equalizes compression in all cylinders—restores lost power—snaps up acceleration—stops “motor ping”—and makes your engine quieter and smoother running.

Get a Karbout Clean-out

Over 100,000 garages and service stations carry Karbout—and can give you a clean-out treatment *while you wait*, for only \$1.00, or you can buy handy 8-oz. cans for giving your motor a treatment—and by regular use in your gasoline prevent further gum and carbon formations that rob you of power.

For Quick relief, give your motor a Karbout clean-out today . . . Descriptive pamphlet sent on request.

THE SHALER COMPANY
Waupun, Wis.

Try This Saucer Test



Take an old piston ring on which there are heavy gum and carbon formations, and place it in an ordinary saucer, covering the ring with KARBOUT. In a

short period of time you will find that with the whisk from a broom, you will be able to clean out the oil ring slots of gum and carbon formations. KARBOUT is guaranteed not to attack or corrode any part of the engine or carburetor.

SHALER KARBOUT

(Contents—Continued)

| | |
|--|-----|
| Sheepskin on workbench oils hand plane | 934 |
| “Fur-lined” screwdriver protects finished work | 936 |
| Counting threads in tapped hole | 944 |
| Rack holds small tools for easy selection | 952 |
| Lid on toolbox serves as handle | 952 |

HOME IMPROVEMENTS

| | |
|--|-----|
| Kitchen knife and brush holders | 907 |
| Extra rooms in the attic | 917 |
| Sewing nook sets any place in home | 924 |
| Patching plastered walls | 928 |
| Sidewalk decorated with tree leaves | 934 |
| Iron handle kept cool with cardboard | 934 |
| Chinese banjos add decorative touch to den | 936 |
| Clothespins on hooks to hang garments | 936 |
| Home problems easily solved | 938 |

LAWN AND GARDEN

| | |
|--|-----|
| “Check-row wire” assures uniform garden planting | 906 |
| Creeping weeds pulled with aid of shoehorn | 910 |
| Growing plants in a window box | 911 |
| Emergency garden-hose nozzle from sprinkler can | 920 |
| Empty seed packages mark garden rows | 920 |
| Decorative feudal castle for your fish pool | 937 |

METAL WORKING

| | |
|--|-----|
| Foot scrapers of heavy sheet metal | 905 |
| Turning in a drill press | 944 |
| Metals in color | 947 |

PHOTOGRAPHY

| | |
|--|-----|
| Negatives dried on towel rack | 904 |
| Printing photos on glossy paper | 915 |
| Exposure time marked on negative with needle | 920 |
| Improving cable release on camera | 928 |
| Getting exposure time for photo filter | 930 |
| Cleaning miniature-camera film | 936 |

POWER TOOLS

| | |
|--|-----|
| Depth gauge for setting circular saw | 913 |
| Eccentric tool-post holder for lathe | 945 |
| Supporting long lathe turning tool | 954 |

STORE AND SHOP

| | |
|---|-----|
| Paper gauge for the typist | 905 |
| Diluting showcard colors | 937 |
| Funnel on glue brush keeps handle clean | 944 |
| Cutting wrapping paper into sheets | 946 |
| Saddle holds milk cans while being repaired | 946 |
| Linoleum unrolled to show customer pattern | 951 |

MISCELLANEOUS

| | |
|--|-----|
| Canvas drawer catches parts dropped from vise | 905 |
| Clothespin lock opened with match | 906 |
| Drying rubber boots quickly | 906 |
| Gauge assures uniform lettering | 907 |
| Chicken hobbles from clothespins | 910 |
| Flat boat inverted on oil drum for diving board | 910 |
| T-square carried on underside of drawing board | 910 |
| Large rock broken with water | 913 |
| Cushion feet for glass graduates | 922 |
| Handkerchief in pocket shaped with cardboard | 922 |
| Keeping slide-rule case closed | 922 |
| Non-sag support arm for workbench lamp | 924 |
| Rubber hose on stirring rod | 924 |
| Simple miter box for workshop | 925 |
| Novelties from Cellophane straws | 926 |
| Cutting tenons for ship models | 928 |
| Windmill pump aerates outdoor fish pool | 929 |
| Invisible support for flowers | 930 |
| Water gauge made easy to read | 930 |
| Clothesline kept taut with auto spring | 934 |
| Tumbling-acrobat toy | 937 |
| Electrical trimmer shapes arrow feathers | 943 |
| Loop hinge to open stepladder | 944 |
| Spanish flat-tile roof imitated with cement | 945 |
| Drawing parallel lines that are equally spaced | 946 |
| Emergency door stop and bumper | 951 |
| Adjustable arbor catcher | 952 |
| Sanders for the modelmaker | 952 |
| Circles quickly divided into number of parts | 953 |
| Extra current for engines having flywheel magnetos | 953 |
| Drill gauge shows size at a glance | 954 |
| Long spout on tube of cement | 954 |
| Printing pictures on aluminum foil | 955 |

IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.



"SHOP PRACTICE & HOME STUDY - brother, they go together!"

● "I work in the shop every day. And a couple of hours every evening, I study. Study what? I don't mind telling you — an I. C. S. Course! Take it from me, shop practice and home study go together. When you combine them you are headed toward more pay — provided you do the same thing I did by mailing a coupon like the one below."

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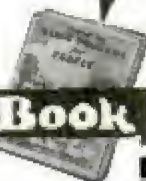
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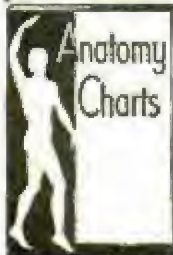
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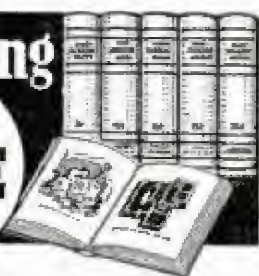
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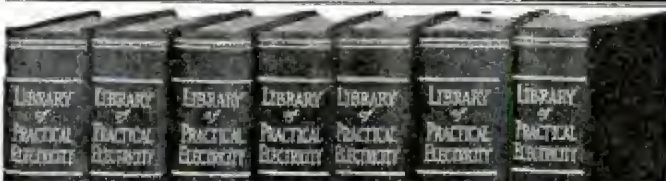
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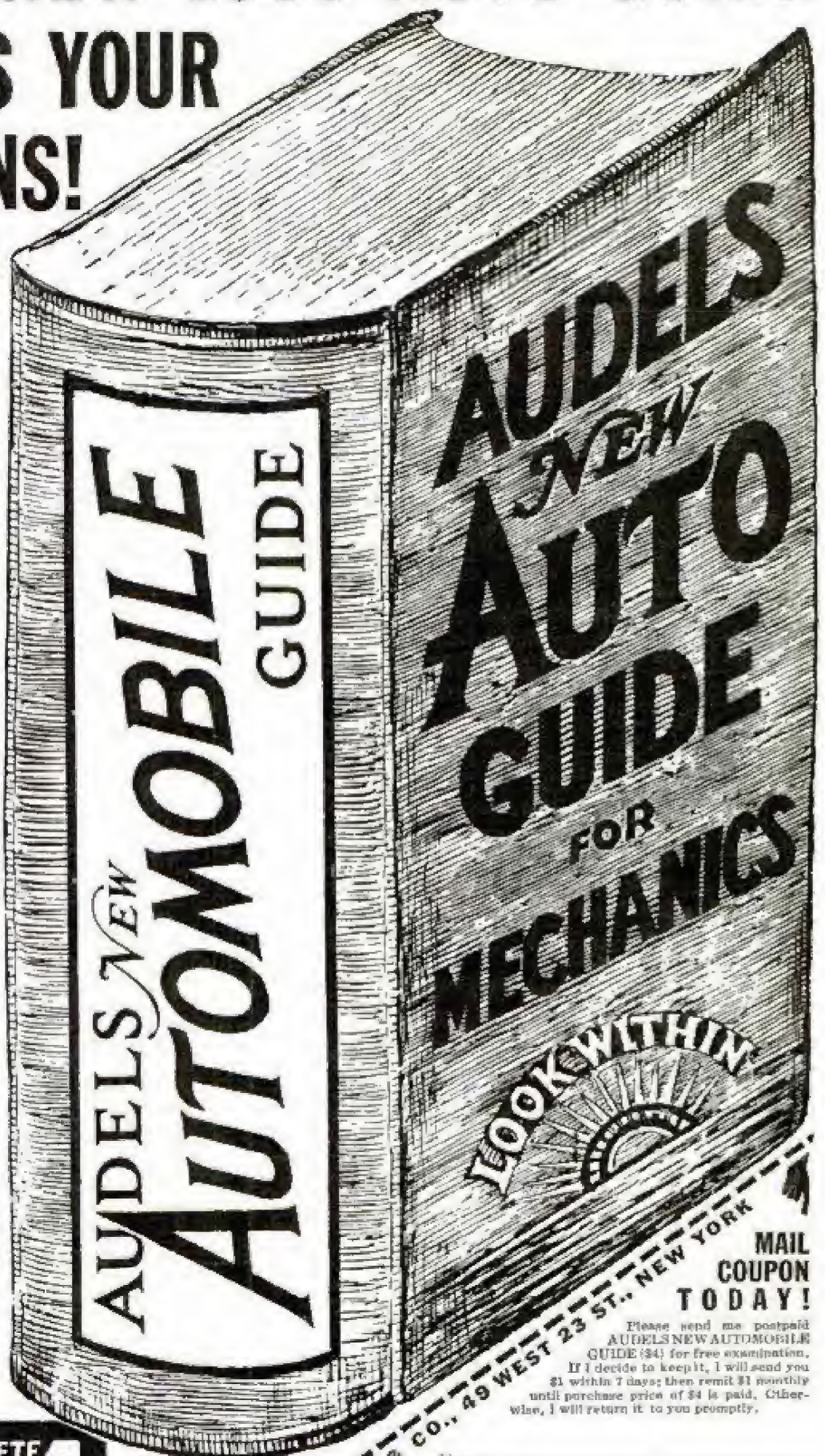
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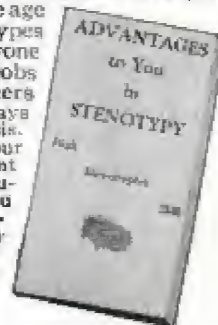
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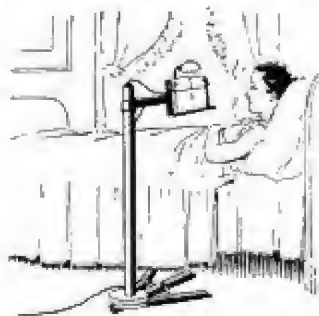


by a device designed for the dentist's use. Attached to the frame holding a magnifying glass is a small electric lamp which illuminates the patient's mouth. The

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HANDY for reading in bed is a collapsible universal book support patented recently. To an

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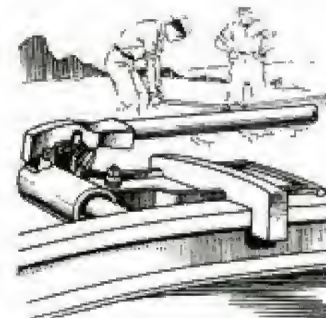
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them on the runners of a sled, something different in sidewalk vehicles may be created. This permits the young owner to use his sled the year around, if he

wishes. Then, when he tires of playing with the roller sled, the trucks may be returned to the skate undamaged. Attachment of the trucks to the sled is accomplished with the skate key.

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(Continued to page 33A)



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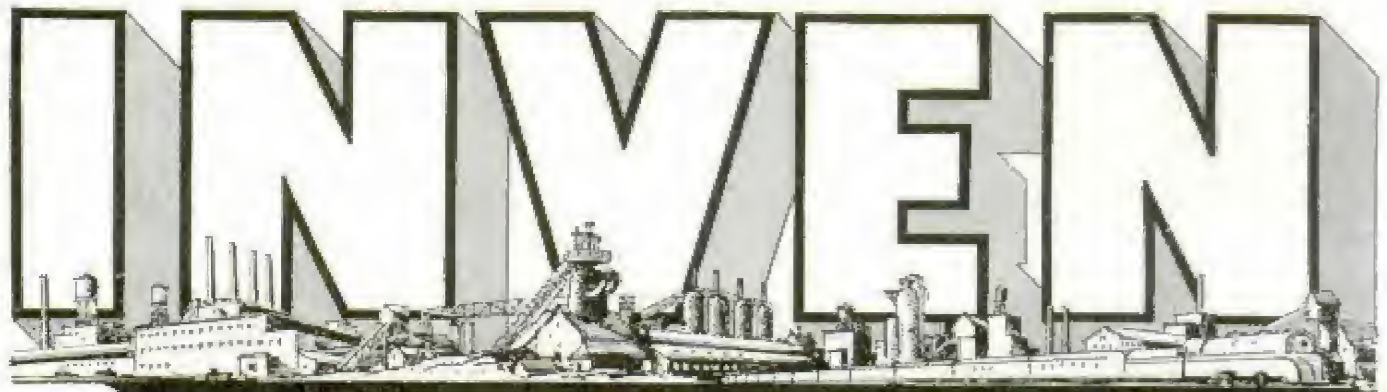


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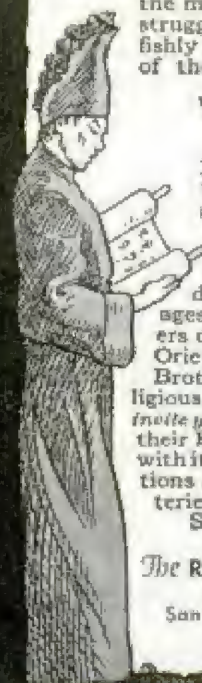
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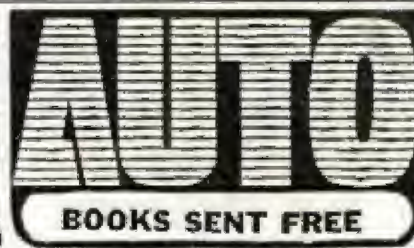
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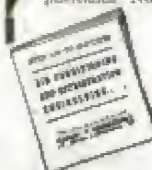
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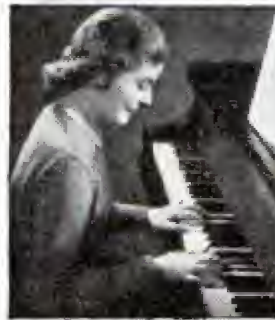
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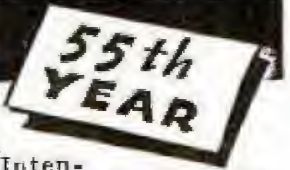


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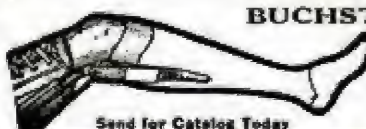
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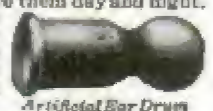
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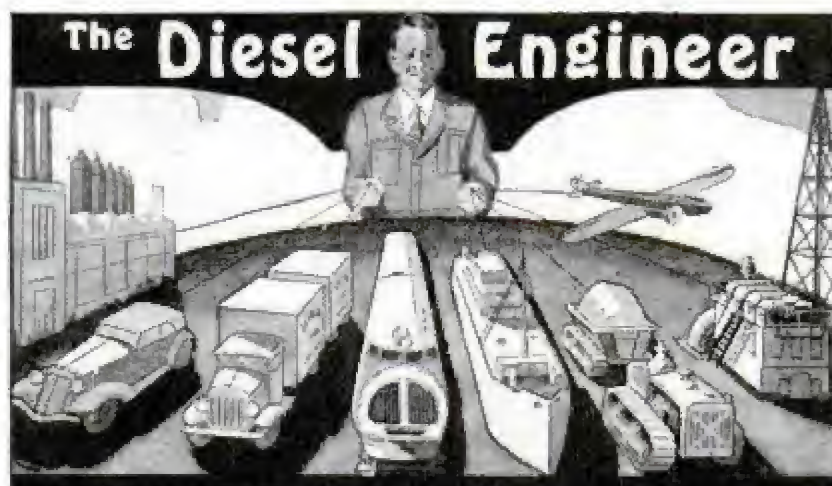
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NEW INVENTIONS

(Continued from page 20A)

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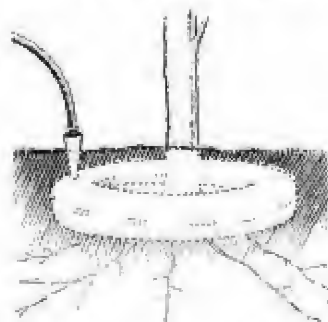
MOTHERS may eliminate worry over whether the baby is covered up at night by using a newly patented sleeping garment. The child is placed inside the garment, which somewhat resembles a small blanket, and buttoned in for the night. Means of buttoning are provided on the back and front of the garment so that the child may be prevented from throwing or kicking off the cover.



MEANS for warning the driver that his automobile is traveling at a dangerous speed is provided in a speedometer patented recently. The speedometer has an opaque dial on which the lower speed numerals are printed, as usual. The high speed numerals, however, are perforated and an electric bulb behind the speedometer illuminates the perforations when the car's speed causes the pointer to move that far around the dial. The high speed numerals are illuminated, warning the driver, until the speed drops below that indicated by the perforated numerals. The speedometer pointer switches the electric bulb on and off.

OFFERING a new means of watering the roots of large plants or trees, a subirrigation device has been patented. It consists of a flexible circular conduit which is buried in the ground surrounding the tree or shrub. A funnel attached to the conduit extends above ground to provide a means of conducting water to the conduit. Openings in the conduit permit the water to seep into the soil.

(Continued to page 54A)



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DIAMOND Shaped air mail—Big packet 105 all different, including air mail, commemoratives, Congo, Epirus, Manchukuo, etc.; set of two ex-King Edwards and Costa Rica diamond shaped air mail; scarce U. S. telegraph, cat. 30c; pkt. British Colonies—Gwallor, Hyderabad, Silver Jubilee; big lists. Everything for 5c to approval applicants. Send today! Mystic Stamp Co., Dept. 80, Camden, New York.

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SAVE On stamp purchases! Details with premium 10c. Aaron Grove, 306 Blanchard, Seattle, Washington.

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BOYS—Join our organization. Earn stamps and cash. For full details address Buick, 17393P Kentucky, Detroit, Mich.

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ECUADOR Darwin commemorative and Ceylon pictorial sets five cents. Approvals. Far Seas Stamp Co., Box 2154, Houston, Texas.

HONDURAS Direct to collectors! Famous airmail commemorating U. S. Constitution 32c postage paid. Pricelist free. R. C. Woodville, Ceiba, Honduras.

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UNITED States approvals! Lowest prices! Adult collectors! Box 822, Minneapolis.

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ECUADOR'S Constitution commemoratives; 100 others, 10c. Distinctive approvals. Woodlawn Stamp Company, 1923 W. Mulberry, San Antonio, Texas.

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25 DIFFERENT Canada 3c to approval applicants. Maynard Sundman, D95, Bristol, Conn.

JOIN! World-wide stamp club. Send stamp for details. Buy-Mor, Box 33, Flint Station, Fall River, Mass.

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ENLARGEMENTS. Colored in oils by experts, from your film or picture, 5x7, 25c; 8x10, 50c. Miller's, 84 Armbruster, Buffalo, N. Y.

MAIL Your rolls to film center of the world. Any 6 or 8 exposure roll developed and printed 25c coin. Deluxe enlargement coupon free! Photo Finishing Shop, Est. 23 yrs., 411-V Genesee Valley Trust Bldg., Rochester, N. Y. "The Camera City."

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35MM. ROLLS Developed and each shot enlarged to 3 1/2 x 4 1/2. \$1.00. Ideal Films, Birmingham, Ala.

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FREE, Two sample reprints. Send negative, 3c postage. Midwest, Humboldt, Iowa.

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NEED Money? Free gift, details. Stamp. King Products, Ahwahnee, Calif.

IMMEDIATE Cash income, advertising! Particulars dime. M. Benton, Liberty, Ky.

BE Progressive. Start full or spare time business of your own. Convert used motor oil into valuable by-product worth 35c pound. Experience not necessary. No extra capital or labor required. Plan sent postpaid, \$1.00. Aero Electric Sales, Hart, Michigan.

ADVERTISING. Chance to make more money. Send 50c for promotion plans. Chippewa Advertising Company, 612 South Franklin, Mount Pleasant, Michigan.

MONEY Making propositions, practical and legitimate. Free particulars. Schembri, P.O. Box 1271, Detroit, Mich.

WANT Money? Send your address. Enclose stamp. Steitlee, 5605 Murray, Mariemont, Ohio.

NOW Make money! A \$1.00 magazine (40th year), filled with schemes, tips, business opportunities, formulas, sent six months for only 30c. "Schemer Monthly," Alliance, Ohio.

STOP Squealing—Start crowing! Work mornings home—country drives or movies—afternoons! No canvassing! Folio-A, Station "D," Los Angeles.

MILLIONS Jobsless! Get dollars in mail daily, like we do, for amazing employment information. Keep money; we fill your orders free. Stamp brings details. Co-Operative Service, 77 Swan, Buffalo, N. Y.

PROFIT In vegetables, flowers, using chemicals. Remarkable yields. Proven formulas. Chemicals for 48 gallons solution. Instructions \$1.00 postpaid. Quick Growth, Hollywood Sta., Box 648, California.

MAN In each town to plate auto parts, reflectors, bicycles, fixtures, mirrors, by late method. Simple plan of manufacturing at home starts you in good paying business. Free particulars and proofs. Gunmetal Co., Ave. N, Decatur, Ill.

RAISE Earthworms for profit. Information free, stamp appreciated. Bureau Zoological Research, 106A Broadway, Peoria, Ill.

MOULDS. Guaranteed, for casting toy soldiers, Indians, trappers, warships, sinker moulds, 244 kinds. Send 5c for illustrated catalogue. Henry C. Schlercke, 645 Spencer, Ghent, N. Y.

107 PLANS For making \$20-\$100 weekly in home or office business of your own. Descriptive booklet free. Elite Co., 214 Grand St., New York.

WHOLESALE Sources, 500,000 articles. Free directory. Maywoode, 925 Broadway, New York.

LIKE To draw? Earn steady income tracing and duplicating advertising cartoons. Ad-Service, Argyle, Wis.

INVESTIGATE Frog raising—a profitable side line. Valuable book explains and illustrates every phase of subject. Covers very latest developments. \$1 postpaid. Popular Mechanics Press, Room (C38), 200 E. Ontario St., Chicago.

FORMULAS, PLANS, ETC.

MAKE Bleach water formula 50c. Capotosto, 1707 Cranston St., Cranston, R. I.

GUARANTEED Formulas—New fast sellers. None better. Lowest prices. Catalog free. Kemico, 49F, Park Ridge, Ill.

FORMULAS: 15 Proven moneymaking formulas \$1.00. (Not stock-formula catalogue stuff), real unusual offers. List free. Marvel Laboratories, 8629 No. Maplewood, Chicago.

EIGHTEEN Money making automobile specialty formulas including the celebrated Petrolube gas saving formula with complete plan for selling by mail. All for only 63 cents. Bucknam, 177 State Street, Boston, Mass.

FORMULAS That please! Let us send proof. World's most popular food flavor. Formula and other details 25c. Rokemko, Waverly, Va.

LATEST Research formulas. Literature free. Research Bureau, 100 Chelsea, Charlestown, Massachusetts.

PERFECTED Formulas with service and problems solved, 25c. Alembic Laboratories, Chemists and Chemical Engineers, Box 1277, Chicago, Illinois.

NO Service like this! Certified formulas based on guaranteed chemical analyses of today's most popular specialties! Stamp brings valuable information. Miller, 1705 Jetton, Tampa, Florida.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

SENSATIONAL Discovery. Remarkable hair grower. Results guaranteed. Ingredients inexpensive. Positive money maker. Prospects everywhere. Formula, complete manufacturing, selling instructions only \$1.00. Never bald, never grey hair secrets free. Unity Service, 2133 N. Third, Milwaukee, Wis.

LUCKY Seven money making formulas, own your own business, become independent, money back guarantee. Send 25c silver. Plan Distributors, 900A Faxon, Memphis, Tenn.

ELEVEN Laboratory tested formulas. Guaranteed moneymakers 25c. Pacific Laboratories, San Pablo, Calif.

POLISH For floor, furniture, formula 50c. Fred Burns, Missoula, Mont.

BEAT Depression. Start manufacturing business. Enormous profits. Send 50c for 200 reliable formulas fast selling products. Technikem Laboratories, 210 5th Ave., New York.

FIFTEEN Best formulas cosmetics, etc., 35c. Master Manufacturing, Boonville, Missouri.

MEN! Shave without razor! Send 25c for formula for self-shaving soap. Carl Greiner, 5112 N. Oakley Ave., Chicago, Ill.

ICELESS Ice! Colder! Cleaner! Cheaper! Instructions, 25c. Duffy, Covington, Ky.

BRUSHLESS False teeth cleaner 15c. Makes 1 gallon. Formula \$1.00. Walsh, 248 Whittenton St., Taunton, Mass.

THAXLY Formulas for perfect products. Accurate analysis assured. Resultful research. Catalog free. B. Thaxly Co., Washington, D. C.

FORMULAS. Latest money makers. Literature free. Belfort, 4042 N. Keeler, Chicago.

10,000 MONEY-MAKING Formulas. Tells you how to make and sell almost everything under the sun; cosmetics, mucilage, anti-freeze solutions, battery solution, beverages, cheese, chewing gum, cleaning preparations, extracts, hair preparations, inks, bluing, leather polish, mirrors, perfumes, polishes, typewriter ribbons, carbon paper, washing powders, liquid soap, and hundreds of other profitable articles. \$4 postpaid. Popular Mechanics Press, Room (C38), 200 E. Ontario St., Chicago.

CHEMISTRY

RUBBER Latex. Dime brings literature, twenty experiments. Eastern Latex Labs., Box 53, Canton, Mass.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Special prices leads. Gibson Laboratory, Chemists, CT-1142 Sunnyside, Chicago.

AMATEUR Bacteriologists—Culture media capsules lists, samples 15 cents. Living amoeba, paramecia 50 cents. Culture Media Laboratories, 136-04 North Hempstead Turnpike, Flushing, New York.

CHEMICALS. Laboratory glassware, apparatus. Send 3c for catalog CP1. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

RARE Chemicals. Sample, dime or stamps. Ernest Snow, Lexington, Mass.

CHEMISTRY. Biology, mineralogy supplies, microscopes, telescopes. Catalog free. Teeko, Evanston, Ill.

HANDBOOK For chemical experimenters, hundreds of experiments, illustrated, 50c. Experiment booklet, 15c. Chemical catalogue, 10c. Reading Scientific Co., Reading, Penna.

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Send 3c for postage. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

AGENTS WANTED

100% PROFIT In new perfected (1938) quick-action self-starting cigar lighter. No flint or friction. No wind can blow it out. Retails 25c. Costs you \$1.75 dozen. Sample and can fluid 25c. New Method Co., Box PM-66, Bradford, Penna.

A BUSINESS Of your own, making Palmer's original chipped glass name plates, numbers, mirrors, signs. Illustrated literature and sample free. E. Palmer, 512, Wooster, Ohio.

400% PROFIT—The Perennio Calendar 640 years. Vest pocket size, 24 pages, \$5.75 hundred. Sample 10c. Box 388, Baltimore, Md.

UP To \$6.00 an hour. Amazing Karnu refinishes autos like new without rubbing, polishing, waxing or painting. Inexpensive—costs little. Wipes on with cloth. Lasts 8 to 12 months. Free sample. Karnu, Dept. F-8, Cincinnati, Ohio.

AT Home, your own manufacturing business, making popular \$1 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. F-842, Cincinnati, Ohio.

BUSINESS Proposition: Resilvering mirrors, autopaets, reflectors, making chipped glass signs. Write, Sprinkle, Plater, 128 Marion, Indiana.

WHOLESALE Catalog free. Razor blades, notions. Bulger, 147C Pemberton, Cambridge, Mass.

JUST Out! Amazing fast selling 25c household necessity. Saves hundreds of dollars. Sell 3 to 4 each home. Make up to \$6 daily. Free sample. Furo, 3107 Pine, Dept. H-298, St. Louis, Mo.

AGENTS Wanted, nationally advertised radios, Philco, GE, RCA, Zenith, etc., send for bargain set and part catalog. United Radio, N-Newark, N. J.

"\$35 WEEKLY From 3 hours homework." 204 other moneymaking plans. Particulars free. Stamford, 826-F Riverside Drive, New York.

SCIENTIFIC Gas Economizer, increases mileage 25-40%. Generous sample and exclusive agents proposition for 3 dimes. Norsemen Chemicals, Crete, Nebraska.

NEW Kind of heat boils water instantly. Make to \$30 daily. Pocket size minute demonstration. No installation. Free offer. No investment. Write the Lux Co., Dept. B-208, Elkhart, Indiana.

NEW Summer deal for red hot immediate action. Mail postcard to nearest office today. Salesmanager, 418 Kasoto Bldg., Minneapolis, Minn. or 407 Victory Bldg., Philadelphia, Penna.

AGENTS Sell water and oil painted portraits. Large commission daily. New York Art Studio, Syracuse, N. Y., Elmwood Station, Dept. 3-A.

GOLD Mine for agents. Up to 200% profit. IMP rings cut gas bills in homes, restaurants, 25% to 50%. Money back guarantee insures quick sales. Rush name for full particulars. Economy Appliances, 2300 W. Van Buren, Chicago.

GET An Esquire electric razor without cost. Earn to \$30 weekly and more spare time. Nothing to sell. Earn-A-Gift, 4942 N. Kedzie, Chicago.

FREE! Mexican framed feathered pictures. 5 1/2x8 1/2 costs 49c, retails \$1.00. Sample 50c stamps, refunded first order. Marquez-P, Apartado 1176, Mexico City.

SELL Patented key holder. Takes no room in pocket. Excellent premium item. Send ten cents for three samples. Jay J. Sindler, Malden, Mass.

AUTOMOTIVE Specialty. Tremendous appeal. Repeater. Get big money facts. Eagle Mfg., 2020 S. 13, Lincoln, Nebr.

BOYS! Girls! Sell vanilla flavoring. Details free. General Products, 776D, Springfield, Mass.

200% PROFIT. Noknot clothes line reel sells on sight at 25c. Carl Clouser, 11 Glynn Terrace, Quincy, Ill.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

SENSATIONAL Guaranteed flavoring extracts! Four bottle—24 ounce assortment worth \$3.20, sells 99c. 100% clear profit! Prepaid freight! Free merchandise! 100 fast selling repeaters! Premiums. Waldorf Products, 1615 Donalson, Los Angeles, California.

MAKE Money selling guaranteed burglar alarms. Fast selling dollar item. Write Sentinel, 216 W. Jackson, Chicago.

BIGGEST Profits! Sell beautiful new household necessity. Women buy on sight. Darco, 3009 North Harding, Chicago.

NEW Amazing product. Sell locally or by mail. Pays splendid profits. Surprise in store for hustlers. Write immediately. Universal Sales, Sta. D, Box 24, Cincinnati, Ohio.

SELL Slogan signs. Carson's Signs, 210 1/2 East James, Flint, Mich.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, RD-1142 Sunnyside, Chicago.

HIGHLY Profitable sideline for men selling hotels, restaurants, hospitals, etc. State lines now representing. Milrox Laboratories, 845 So. Wabash, Chicago.

SIDEL'S Universal polishing cloths. Fast 25c sellers. Sample 10c. Scruggs Company, Box 3023, Chattanooga, Tenn.

CERTIFIED Formulas duplicating agents most popular specialties. All lines. No service like this. Stamp brings interesting information. Miller, Jetton, Tampa, Fla.

SELL New sheepskin auto washing mitts. Write: Maupin, Gainesville, Texas.

AGENTS—New greeting card sales plan. Particulars free. Box 198, Pottstown, Penna.

MONEY In butterflies, moths. See Sinclair Display Advertisement on page 18A.

I'LL Give you groceries at wholesale besides splendid opportunity to make up to \$45.00 in a week. Brand new Ford sedan given as bonus. Details free. Albert Mills, 6224 Monmouth, Cincinnati, Ohio.

EARN Easy money giving away Packard Lektro Shavers. Free sample sales card and full particulars. Distributors, Box 285, Altoona, Penna.

SELL Beautiful 1939 art calendars low as 100 for \$3.95. Every business buys. Orders being placed; start quick! Big commissions daily. Write! New England Art Publishers, North Abington, 36, Mass.

DISTRIBUTORS To sell fast moving items direct to housewife. Good opportunity. Write for particulars. Polyshine, Inc., Rochester, New York.

NEW Invention! Sanitary toilet seat lifter. Unlimited sales bringing large daily profits to agents. Sample 25c. Security Products, Box 124, Sacramento, California.

AGENTS Make bigger profits on food products-bargain deals. Low wholesale prices. Big display case sent on trial. Ho-Ro-Co, 2610-R Dodier St., St. Louis, Mo.

AMAZING Sharpener—100 shaves from same blade. 400% profit. \$1.00 sample 25c. Dallas Ruth, Wheelersburg, Ohio.

BIG Money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 40, Dunellen, New Jersey.

AGENTS Wanted. Razor blades. Big profit. Louis Eugene, 277 Broadway, New York.

FREE Typewriter. Outfit 25c. Details free. Associated, Southside, Oil City, Pennsylvania.

STARTLING Invention—Pocket adding machine. Nationally advertised \$2.50. Whirlwind seller. Big profits. Calculator Mfg. Co., Box 1118, Chicago.

PRIVATE Brand cosmetics and toilet preparations. We print your name on the labels. 200% to 400% profit. Send for complete details and prices. National Scientific Laboratories, 1910W Broad, Richmond, Va.

ATLAS Window sign letters. Large sizes, penny each. Beautiful free samples. Atlas, 7941 Halsted, Chicago.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for name plates and tire cover transfers. "Ralco," 1365 Washington, Boston, Mass.

BIG Money taking orders; shirts, ties, hosiery, underwear, raincoats, pants, uniforms, etc. Sales equipment free! Experience unnecessary. Write Nimrod, Dept. 8, 4922-28 Lincoln, Chicago.

500% PROFIT! Gold and colored sign letters for windows, offices, trucks, signs. Auto monograms. Easily applied by agent or customer. Neonite, Akron, Ohio.

AGENTS: Smash go prices! Santos coffee 12c lb. 4 oz. vanilla 8 1/2c. Razor blades 10 for 8 1/2c. 100 sticks chewing gum 12c. 150 other bargains. Premiums. Experience unnecessary. Carnation Co., PO, St. Louis, Mo.

GUARANTEED Gold leaf letters for store and office windows. 500% profit. Free samples. Metallic Co., 438-B N. Clark, Chicago.

MAN In each town to plate auto parts, reflectors, bicycles, fixtures, mirrors, by late method. Simple plan of manufacturing at home starts you in good paying business. Free particulars and proofs. Gunmetal Co., Ave. H, Decatur, Ill.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 149 Fifth Ave., New York.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

AGENTS—Opportunity to make money; book containing 107 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 1107-F Broadway, New York.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

LUREX Quickly removes lime and rust stains from both tubs and sinks. Sells to homes, hospitals, apartments. Sample 25c. Lurie Company, Indianapolis, Indiana.

200% PROFIT On telephone call counters at 5c each. Monthly repeat sales or saleable in multiple. Samples: 2-10c, 12-25c; 100-\$1.75; 1000-\$16.55. Tele-Tally, 1614 65th Avenue, Oakland, California.

HIGH-GRADE SALESMEN

BIG Cash daily; cash bonuses regularly. Sell Sanforized shirts, ties, hose, underwear direct to wearer. Guaranteed full year. Sensational style and quality features. Sales outfit free. Write today Dept. PM-6, Rosecliff-Quaker, 1239 Broadway, New York.

AGGRESSIVE Salesmen for exclusive sales rights on famous, Proven King Products. Constant money-maker. Fast repeater. 100% profit. Earn \$5000 up yearly. Successfully sold for years. Don't waste time. Pick a winner. Write King Mfg. Co., 1701 Maplewood Ave., Flint, Mich.

DID You make \$50 last week? Does your job offer you real future? If not, why not start a wholesale business of your own? Little or no capital needed. Handle line 200 nationally advertised 5c-10c products. Show merchants new plan for increasing sales and profits. Handle everything from your home at start. Chance to operate one of our Silver Fleet service trucks. Facts free. World's Products Co., Dept. 6810, Spencer, Ind.

SELL America's most complete line of business necessities. Regular and novelty size book matches, gummed labels, political items, pricing sets, restaurant supplies, salesbooks, engraved like stationery, shipping room supplies, office supplies, printed gummed tape, advertising chewing gum, advertising pencils, thermometers, business stimulants. Complete line printed business forms and hundreds of other fast sellers. Business cards \$1.50 thousand. Stationery \$2.70 thousand. All competition undersold. Cash commissions advanced daily, extra bonus. Experience unnecessary. Complete sales outfit free. Federal, AH-301 South Desplaines, Chicago.

PATENTED Zipper "Money Safe" inside our genuine cowhide monogrammed trouser belts. Pockets pickpockets. Saves cash. Take orders. Collect big cash profits immediately. We deliver. Write for free demonstrator sample offer. Initial-It, 508 North Dearborn, Chicago.

SALESMEN, Distributors—Established company. New automotive system all car and fleet owners vitally need. Sells for only \$2.95. Lloyds of London Insurance up to \$5,000.00. Makes quick convincing demonstration. Large repeat business. New proven merchandising plan to dealers carries 100% insurance protection for you. Profits up to \$600.00 per month. Exclusive territories. Guaranteed sales or money back under Plan A. Write today for details of full-size test sample and all facts. No obligation. Craver-Jay Corporation, 105, Kansas City, Missouri.

SANDERSON'S Book matches (Ottawa, Illinois) offer salesmen best proposition.

SELL Fans, calendars to merchants. Free samples to producers. Casey Calendar Co., Knoxville, Iowa.

IF You are ambitious you can make good money with a Rawleigh route. We help you get started. No capital or experience needed. Steady work for right man. Sales way up this year. Write Rawleigh's, Box P-2-PPM, Freeport, Ill.

SALESMEN: Sell business stationery, book matches, advertising gummed tape, advertising pencils, shelf moulding, labels, salesbooks, rubber stamps, tags, office supplies. Business cards \$1.50 thousand. 35% comm. daily. Free deals. Sales portfolio free. Willens, 2130 Gladys, Dept. 2X, Chicago.

UP TO \$95.00 weekly. Also open to side line men. \$500.000 punch board firm announces new items. No investment. Complete sales kit free. K&S Sales Co., 6227 Broadway, Dept. C126, Chicago.

BIG Commissions selling stores celluloid pricing tickets, metal shelf moulding, menu covers, signs, chrome changeable letters. P. Pricing Press, 124 White St., New York.

CALLING All brush salesmen—Make 100% profit selling the newest magnetic electric brush, attractive sponge rubber brushes and other rubber items. Household chemicals, polishes, waxes, silver cloths, fly sprays, moth destroyers, kitchen aids, plus a wonderful complete line of quality brushes, mops, brooms, etc., tested and approved by Good Housekeeping Institute. All salesmen make 100% profit plus an immediate opportunity to become manager with a company established fifteen years. Write Advertising Department, Donald Brush Company, Camden, N. J.

20,000 MILES From weak, discarded tires with Tire Armor—a selling sensation! We deliver. Liberal commission. Motor Products, 1760-H Lunt, Chicago.

"\$35 WEEKLY From 3 hours homework." 204 other moneymaking plans. Particulars free. Stanford, 826-F Riverside Drive, New York.

UNLIMITED Profits. Granite monuments. Lettered. Prepaid. \$9.90 up. Free catalog. Mikellch Company, St. Cloud, Minnesota.

STORES Clamoring for soilless plant grower. Sell Grolast. Tremendous profits. Barter, 3937 Tracy, Kansas City, Mo.

\$9,999.99 CAPACITY Pocket size calculator. Retail price only \$1.00! Get agents offer. Lundgren, 332-S Neville Bldg., Omaha, Nebraska.

BLADES. Factory prices. Free delivery. Ace Blades, Dept. 5-D, Rochester, N. Y.

STEADY Repeat: Guaranteed lubricants, soaps, cleaners, waxes, disinfectants, auto chemicals. Old reliable manufacturers. Liberal commissions weekly. Big market. Selling equipment free. Let us explain. Baum's Castorine, Rome, N. Y.

SELL The Driving Master. Shows miles per gallon when driving. Analyzes motor troubles. September, 1936. Popular Mechanics described fully. Driving Master Company, Sioux City, Iowa.

OPPORTUNITY. Make up to \$95 weekly with astounding new product needed in every home. Gold mine for state, county, local distributors. Sensational sales. No competition. Nothing like it. Free gift plan gets automatic repeat orders. Write quick. Arwell, Inc., Dept. 55, Waukegan, Ill.

LIVE Distributors wanted for new food sensation. Selling like wildfire to stores, cafes. \$5.87 profit per case. Wire or airmail for exclusive territory. Minute Foods, 257-ED Werdin Pl., Los Angeles.

MAKE Up to \$50.00 weekly part time selling Top Quality advertising book matches at low prices. Experience unnecessary. We train you. Full time profits unlimited. Free sales kit. Match Corp. of America, Dept. E-6, 6041 W. Grand, Chicago.

TIRE Accessories. Guaranteed 10,000 mile Tiger Grip Tire Patch, and complete fast-selling line auto accessories. Salesmen-distributors easily make up to \$75 weekly, and over. Protected territory. Economy Rubber Products Co., 628 Burkhardt, Dayton, Ohio.

DISTRIBUTORS For electric dry shaver retailing \$5.95. No stock investment. Allen Razor Company, 2321 Allen, Allentown, Penna.

SALESMEN'S Paradise—New electric guaranteed dry shave razor. Cost \$3—Big \$2.00 profit for you. Write, wire Universal Industries, 6227 Broadway, Dept. C126, Chicago.

MANAGERS Wanted in every city and town. Small investment will realize \$100.00 weekly. Sayers Systems, 2801-03 Sheffield Ave., Chicago, Ill.

CANVASSERS. Fast selling pictures. Mexart Company, 102 Lewis, San Antonio, Texas.

SELL New sheepskin auto washing mitts. Write: Maupin, Gainesville, Texas.

SPARKLING Glo-Brite signs sell fast to stores, restaurants, taverns. Lasting gold finish. Religious mottoes. J. A. Baxter, Cambridge, Ohio.

SALESMEN: Sell advertising novelties, calendars, fans, thermometers, etc., for nationally known firm. Liberal commissions. Stanwood Hillson Corp., 21 Station St., Brookline, Mass.

BIG Money taking orders; shirts, ties, hosiery, underwear, raincoats, pants, uniforms, etc. Sales equipment free! Experience unnecessary. Write Nimrod, Dept. 65, 4922-28 Lincoln, Chicago.

WANTED. Monumental salesman everywhere. Marble-Granite Company, A-17, Oneo, Fla.

ATLAS Window sign letters. Large sizes. Penny each. Beautiful free samples. Atlas, 7941 Halsted, Chicago.

OUR New 1938 complete line of brushes now ready. Largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Farrell cleared over \$1,600.00 monthly. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

GUARANTEED Gold leaf letters for store windows. Free samples. Liberal offer to car owners. Metallic Co., 438-A N. Clark, Chicago.

MAKE More money with Red Comet Automatic Fire Extinguishers. Low price. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Bldg., Littleton, Colo.

FREE Booklet describes 107 plans for making \$20-\$100 weekly. In home or office, business of your own. Elite Co., 214 Grand St., New York.

DISTRIBUTORS Making big money introducing latest sensation—Chemical Growing. Produces larger flowers, vegetables, indoors, outdoors, without soil. Good territory still open. Wire, airmail. Chem-Grow, 257-HU Werdin Pl., Los Angeles.

HELP WANTED

WEAR Fine hose I send without cost with outfit while taking orders for amazing new hosiery. Replacement guaranteed against holes, snags, and runs. Rush name and hose size. Wilknit, Desk 37-F, Greenfield, Ohio.

WANTED—Men to represent large shoe company. Good pay every day. No experience needed. Complete sales outfit sent free. Write Consolidated Shoe System, Dept. S31, Chippewa Falls, Wisconsin.

LOCAL Agents wanted to wear and demonstrate free suits to friends. No canvassing. Up to \$12 in a day easy. Experience unnecessary. Valuable demonstrating equipment, actual samples free. H. J. Graves, Pres., 1300 Harrison, Dept. F-817, Chicago.

"ANT Buttons" kills thousands ants, roaches, flies, wasps, silverfish, waterbugs, insects, rats, mice. Guaranteed! Send 40c samples. P.O. Box 4, Miami Beach, Fla.

MEN Wanted for coffee routes. Earnings up to \$42.50 first week. Brand new Ford sedan given you as bonus. I send everything; you don't risk a penny. Details free. Albert Mills, 6218 Monmouth, Cincinnati, Ohio.

EDUCATIONAL AND INSTRUCTION

LEARN Fascinating, profitable profession of Swedish massage at home in 90 days. Make up to \$70 weekly. Write for free anatomy charts and details. The College of Swedish Massage, 1601 Warren Blvd., Dept. A44, Chicago, Ill.

"SHORTHAND Simplified" \$1.00. Lesson 10c. Teaching opportunity. Simmons, Rocky Hill, Conn.

DON'T Be afraid of the holdup man, or the bully just because you are below the average in size or strength. You can make up for this deficiency with a little scientific instruction in Jiu-Jitsu which will be sent to you for only \$1.00. James Cole's Jiu-Jitsu Instructor, Box 6095, Cleveland, Ohio.

INDIVIDUAL Dancing instruction by mail. Beginners, advanced. Latest steps. Stamp brings personal fault-finding chart. Box 66, Sta. W, Brooklyn, N. Y.

FOR An extremely profitable lifetime business, operate a collection-credit agency. Free folder. Cole Associates, Syracuse, N. Y.

\$105-\$175 MONTH. Get U. S. government job. Try next examinations. Common education sufficient. Full particulars, list jobs, sample coaching, free. Write today. Franklin Institute, Dept. S3, Rochester, N. Y.

BECOME An investigator. Remarkable "Test Question, Problem and Lesson Correction Method." Modern, practical, thorough. Profusely illustrated. Particulars free. International Secret Service Institute, PM 68, Hoboken, N. J.

LEARN Electric welding. Modern trade, jobs everywhere; good money. Our short practical shop course trains you. Established 1918. Welding Company, 4100 Paul Street, Philadelphia, Penna.

STUDY For a degree in psychology, metaphysics, truth, theology. Home study. Chartered college. Free catalog. College of Universal Truth, 1100 N. Dearborn Chicago.

TELEGRAPHY Taught thoroughly. New railroad retirement act creating renewed openings for operators. Enroll now. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

BUSINESS Improving. Thousands positions opening. Land good job now. Write. Employment Counsellors, Box 1283K, Milwaukee, Wisconsin.

BECOME A columnist. Pamphlet free. 10 years experience. Ben Arid, Station D, Los Angeles, Calif.

SELL Insurance. All kinds. Training and placement service. Vocational Guidance Institute, Boonton, New Jersey.

SUCCESSFUL Men are "realists." Send 10c and learn to become one. Realist League, 45 Abbey Court, Brooklyn, N. Y.

MASSAGE, Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

MAKE More money. Get a U. S. government job. Get our new plan for obtaining one—no obligations. Age 18-50. Write. Instruction Service, 101, St. Louis, Mo., immediately.

GOV'T Jobs start \$1250-\$2100 year. Men-women age 18-50. Former examiner's tested method helps qualify you. Particulars, list jobs free. Write today. Patterson School, 8C Mercantile Bldg., Rochester, N. Y.

DEGREES Earned by home study in arts, sciences, philosophy, education, psychology, theology, law, chemistry, engineering, business, agriculture. McKinley-Roosevelt College, Chicago.

EARN Extra money! Clipping and preparing newspaper articles for publishers. Simple; fascinating; profitable. Send stamp. Division 55A, National Press, 3923 W. Sixth, Los Angeles, Calif.

LEARN Machinist trade, tool, die making. Automatic and hand screw machines. Modern shop methods. Actual work. Jobs open for trained men. Employment help. Illustrated booklet free. Allied Screw Machine Co., 601 Lake St., Chicago.

LEARN Auto mechanics. body, repairing, welding, electricity, refrigeration, Diesel. Stevenson's, 2008A Main, Kansas City, Mo.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

PAINT Signs for profit. Fine lettering fast with Speedway Patterns. Modern styles, many sizes. Unique method. Free samples, literature. Enclose 6c stamps for valuable 3-in. alphabet. Display-Letters Co., Station 235-G, New York.

LETTERING Made easy. "A to Z." Two volumes. \$2.00. Guaranteed. Samples. Stein Studios, Flatiron Building, New York.

ART. Large beautiful oil painting on black velvet \$1. Satisfaction guaranteed. Photoart, 857 S. 89 St., Wauwatosa, Wis.

CHALK Talks. Laugh producing program. \$1.00. Catalog 10c. Balda, the Cartoonist, Oshkosh, Wisconsin.

BECOME Artists overnight. New deluxe Mur-O-Graph enables one to draw excellent cartoons, portraits, posters, etc., without training. Enlarge pictures from one up to thirty inches. Not a toy. Simple, durable, accurate. Guaranteed. Thousands in use. One dollar postpaid. Literature free. Mur-O-Graph Company, Irving, Texas.

CARTOONING, Sketching, etc.—46 lessons, 600 illustrations, including drawing paper, pens, pencils. \$1.00 complete. Fraba Service, Cashton, Wisconsin.

MAKE More money making signs and showcards! Easy simplified system \$2 postpaid. Write Silvio Signs, B-1821, San Antonio, Texas.

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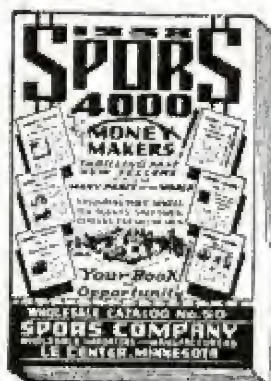
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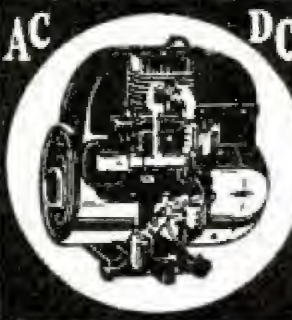
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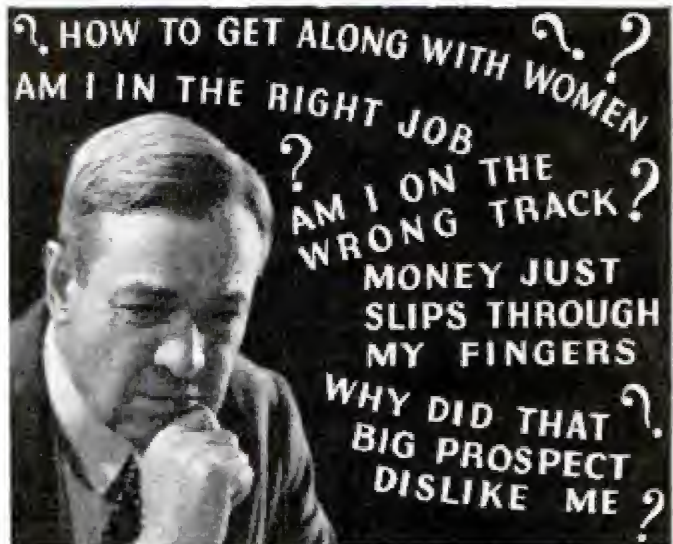
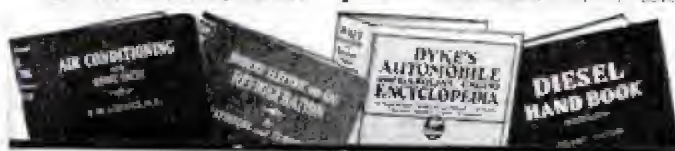
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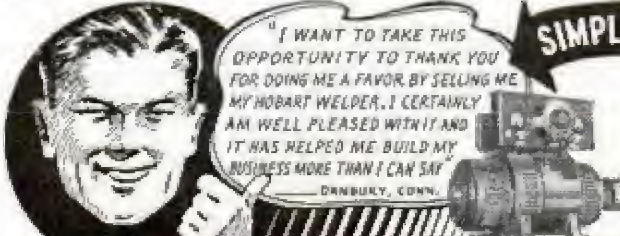
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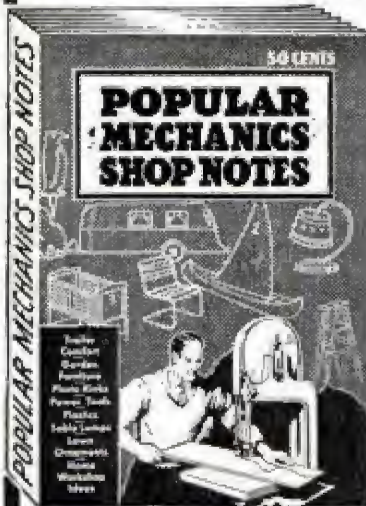
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MILLIONS AND MILLIONS

Of Kelpamalt Tablets—The
Excellent Mineral-Iodine
Concentrate—Used by Peo-
ple The World Over! Thou-
sands Report New Pounds,
New Strength, New Energy.

Don't resign yourself to being a skinny, scrawny, physical wreck! Kelpamalt, the improved mineral-iodine concentrate, has put solid, attractive pounds on thousands who were underweight for years. That's because the body's normal chemical processes, which change digested food into rich blood and firm flesh, require certain minerals

—elements often deficient in the daily diet. Without them, good nourishment may be wasted. **KELPAMALT HELPS PROVIDE THESE NUTRITIONAL ELEMENTS.** Its iron, copper, calcium and other minerals, together with its natural, sea-plant iodine, help the system get the real good out of food. Try it. Thousands are amazed at quick gains of solid, "stay-there" flesh often in a few weeks. They say they eat better, sleep better, look better, feel better, too. Kelpamalt costs but little to use. Your own Doctor will approve this harmless way. Get Seedol Kelpamalt today.

SPECIAL FREE OFFER

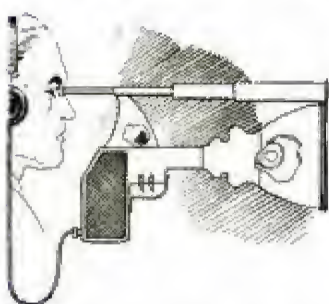
Send for Free, fascinating, instructive, 50-page booklet on How to Build Strength and Add Weight. Information on Minerals, Iodine and Vitamins, and their effects on the human body. Weight and Measurement Charts. Daily menus. No obligation. **Kelpamalt Co., Dept. 1437, Borden Ave. and 21st St., N. Y. C.**

Seedol Kelpamalt Tablets

NEW INVENTIONS

(Continued from page 33A)

ULTRASHORT radio waves are employed in a new system of signaling.



The outfit is a lightweight transmitter capable of being operated by one man. It consists of an elongated casing provided at its forward end with a concave mirror

and at its rear end with a hand grip and a microphone. It also has an ultrashort wave oscillator in the mirror, and switch-controlled lead-in wires arranged to form a tunable Lecher system within the casing properly connected to a source of current, the microphone and the oscillator. The outfit is used for signaling over relatively short distances.

MIXING summer drinks would not be such a task if the kitchen equipment included a newly patented ice-cube crusher. The device consists of a pair of crushing jaws pivoted and extending to form a handle. A spring holds the jaws apart until the ice cube is inserted, and pressure is applied to the handle in the manner of using a nutcracker. Small ice picks on the inside of the jaws help to crush the cube.



WOODSMEN would find a newly patented tool handy. It is a combination ax and pick and its handle contains a hunting knife. The knife is firmly held within the handle until its release for use is desired. The pick may be folded against the handle when not in use.



REDUCING work for the farmer is the purpose of a combined cultivator and



weed cutter patented recently. The implement has a pair of rearwardly diverged blades having their rear ends rigidly connected with a U-shaped member. A gauge

wheel is adjustably mounted on the frame in advance of the blades. By cutting the weeds and cultivating the soil the implement serves a double purpose.

OPERATED by an electromagnet, a simple fret saw has been introduced in Germany. The electromagnet is located below a steel diaphragm supported in rubber holders. On the upper side of the diaphragm, in the center, is a clamp in which the lower end of the fret saw is fixed, while the upper end of the saw is fixed to a flexible bow. The coil of the electromagnet is connected to an ordinary a.c. lighting circuit, and the alternating field produced results in the upward and downward deflection of the diaphragm at each half period. With a periodicity of fifty, the diaphragm makes 6,000 vibrations per minute. The length of the strike may be varied by altering the vertical position of the electromagnet by means of a screw. The saw may be started or stopped by pedal or hand switch.

FOR the radio enthusiast, an antenna belt patented recently offers the means

for new experiment with the small receiver. The antenna is fastened around the waist. A special harness, which is worn like a cap, is connected to the receiver. Headphones attached to the harness, on each side of the head, provide for reception of signals.



VACU-MATIC SCORES AGAIN!

BOB McKENZIE

TRANSCONTINENTAL AUTOMOBILE CHAMPION
COAST TO COAST

WESTERN UNION
TIMED

NEW YORK
TO
LOS ANGELES
24 hrs. 45 min.

LOS ANGELES
TO
NEW YORK
27 hrs. 34 min.

CANADA
15,000 miles
in 10 days

LOS ANGELES
TO
NEW YORK
24 hrs. 45 min.

WASHINGTON, D. C.
TO
MEXICO CITY
24 hrs. 45 min.

LOS ANGELES
TO
PHOENIX
8 hrs. 15 min.

MURKIN DRIVE
1937 W. 1000

LOS ANGELES
TO
MEXICO CITY
24 hrs. 45 min.

LOS ANGELES
TO
PHOENIX
8 hrs. 15 min.

MURKIN DRIVE
1937 W. 1000

Vacu-matic Carburetor Co.
7617 W. State St.
Wauwatosa, Wisconsin

Dear Sirs:

Having just completed a new speed record between Los Angeles and Chicago, driving a 1936 Chevrolet equipped with a Vacu-matic carburetor control, I thought you might be interested in knowing some of the facts and the important part Vacu-matic played in the success of the run.

The distance covered was 2322 miles in thirty nine hours and forty-two minutes, officially timed by Western Union, which gave me an average speed of 59.7 M.P.H. based on elapsed time and with the Vacu-matic averaged 18 1/2 miles per gallon on gasoline.

Before leaving Los Angeles, we made several test runs both with and without the Vacu-matic, and the tests proved that Vacu-matic increased my gas mileage 3 1/2 miles per gallon at the driving speed of 80 M.P.H. and also very noticeable increase in both acceleration and power.

After this experience with Vacu-matic, you can depend that on my future speed runs across country that I will be depending on Vacu-matic to give me the same added performance it has proven on this last record breaking drive.

Yours very truly,

Bob McKenzie



**Sets New
Coast-to-Chicago
Record**

**New Supercharge
Principle
SAVES GAS**

**MORE POWER - MORE SPEED
FASTER PICK-UP - NEW LIFE**

ESTABLISHING new mileage records on cars in all sections of the country, the Vacu-matic again scores in a new speed record established by Bob McKenzie transcontinental automobile champion. Los Angeles to Chicago—2,322 miles in 39 hours and 42 minutes—driving 75 and 80 to maintain a speed average of 59.7 miles per hour!

Here is speed—a gruelling grind—where quick acceleration, greater top speed—and less stops for gasoline mean those precious moments saved that make new speed records possible.

The same Vacu-matic that helped Bob McKenzie establish this speed record and gave him such fine gas savings is now available for all car owners. It is positively automatic—simple to install—inexpensive—and pays for itself many times over in gas savings.

Automatic - - Nothing Like It!

Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air, into the heart of the gas mixture. It is entirely AUTOMATIC and allows the motor to "breathe" at the correct time, opening and closing automatically as required. No idling troubles—no carburetor adjustments necessary. It is so simple it will amaze you—so practical it will save you many dollars on gas costs.

Fits All Cars

VACU-MATIC is constructed of six parts, assembled and fused into one unit, correctly adjusted and sealed at the factory. Nothing to regulate. Easily attached in ten minutes.

Agents and Salesmen

VACU-MATIC offers a splendid opportunity for unusual sales and profits. Valuable territories now being assigned. Check and mail coupon.

The VACU-MATIC Co.

Wauwatosa, Wis.

Guaranteed Gas Savings

VACU-MATIC must prove itself on every car. It is guaranteed to give worthwhile gas savings, quicker pick-up and more power, or it costs you nothing. "On my V-8 Ford it works miracles", says Ralph Fields. James Seeley—"On an International Truck on a round trip to Cleveland, 385 miles, it saved 19 gallons of gas." A. V. Grove—"On the Buick it showed 5 miles more per gallon." F. S. Peck—"I average 22 miles per gal. on my Plymouth, an increase of 7 miles, for a saving of \$15.00 a month, or \$180.00 a year." Wm. Lyons—"Averaged 25 miles on a gal. with a Model A Ford at 40 miles per hour."

Free Details

You owe it to yourself to know all about this remarkable discovery. Mail the coupon below. Start saving gas with VACU-MATIC and enjoy a new driving thrill! There's no obligation—so get the facts now! Write today!

— — — FREE OFFER COUPON — — —

THE VACU-MATIC COMPANY
7617-390 W. State St., Wauwatosa, Wis.

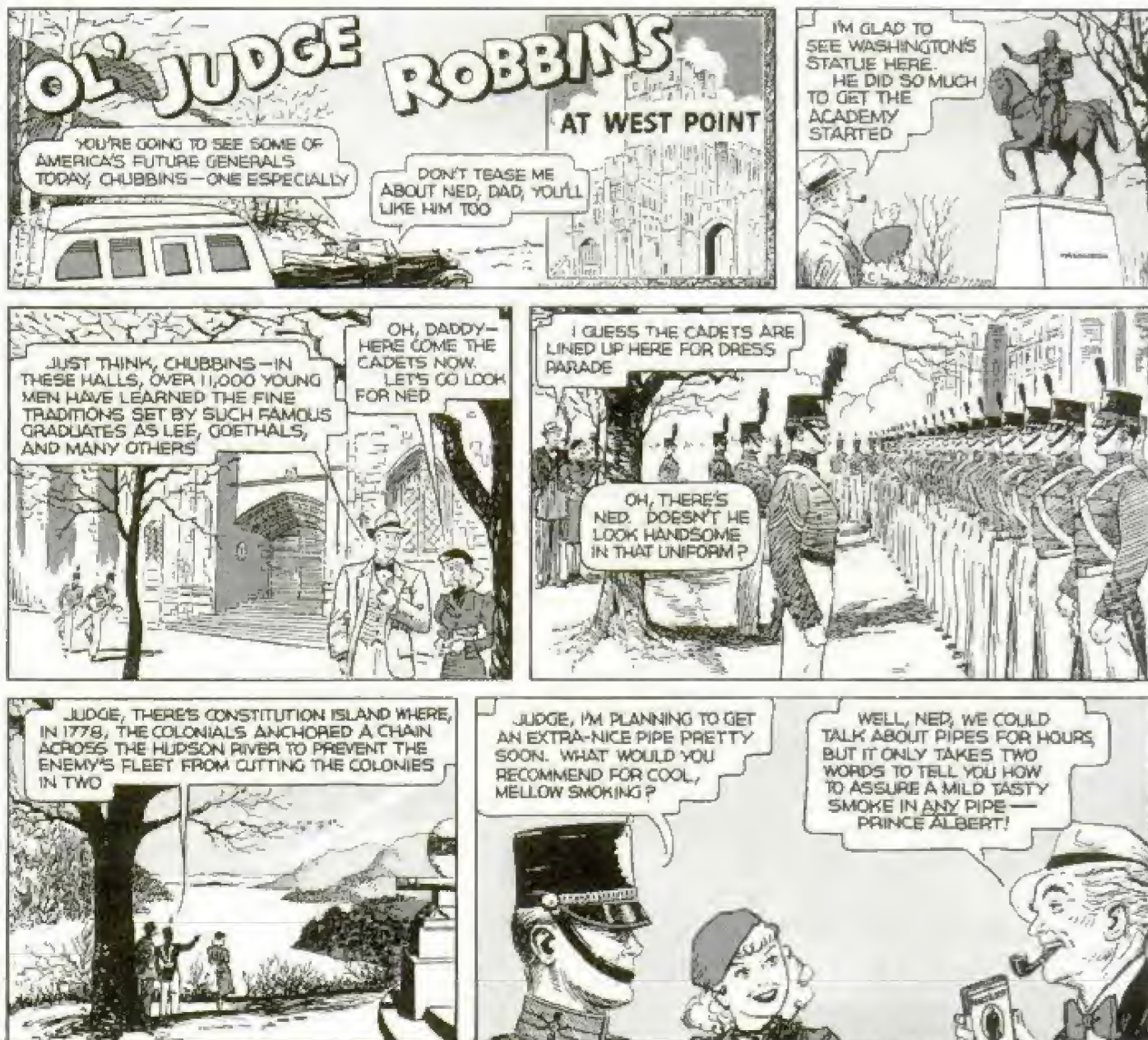
Gentlemen: Please send me full particulars concerning the Vacu-matic and details of your Free Offer. This of course does not obligate me in any way.

Name

Address

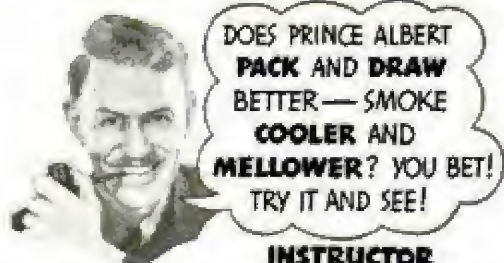
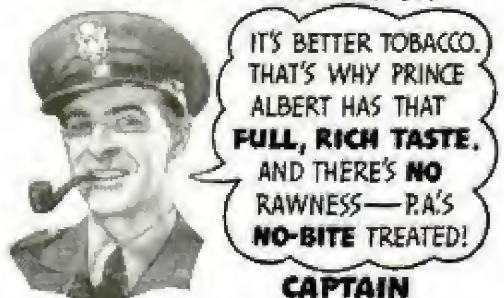
City State

☐ Check here if interested in selling proposition.



Copyright, 1938, R. J. Reynolds Tobacco Co.

★ **JOIN THE ARMY OF JOY-SMOKERS!** Here's the ★
 ★ **world's favorite pipe tobacco for MILDNESS and RICH TASTE** ★

**INSTRUCTOR****MONEY-BACK OFFER**

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage. (Signed) R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

P. A. IS MADE TO ORDER FOR BETTER "MAKIN'S" SMOKES TOO!

50

pipefuls of fragrant tobacco in every 2-oz. tin of Prince Albert

THE **2** OZ. TIN
SO MILD SO TASTY



PRINCE ALBERT
 THE NATIONAL JOY SMOKE

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

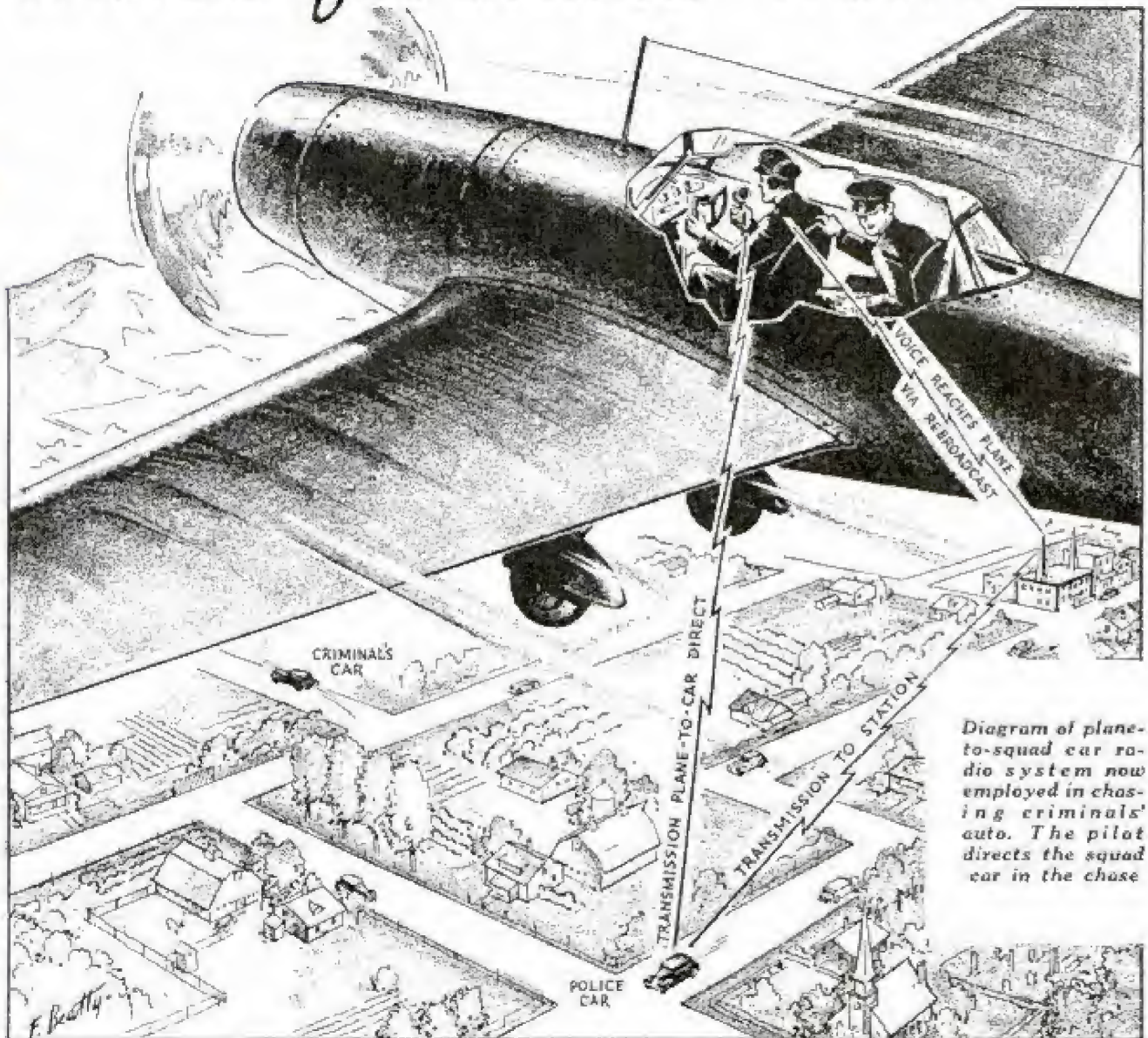
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 69

JUNE, 1938

No. 6

WINGS^{14 285} for CRIME HUNTERS



THE picturesque, gun-toting sheriff of the old west is fast fading. The sheriff's department of San Diego county, Calif. has perfected and put into use "plane-to-car" radio communication, the culmination of several months' experimentation.

On the regular staff of the department, and in charge of the bureau of identification, is Lieutenant John Dougherty, licensed pilot and airplane owner, who on

many occasions has been called upon to direct rescue work, run down fugitive criminals and head searching parties from the sky. Until recently, his only means of communication with the ground forces has been a pre-arranged set of maneuvers, indicating the positions of the parties when located.

After much trial and error experimenting with different types of radios, both

3568 Keating St.
San Diego Calif



aircraft and ground conversion sets, a popular type of short-range aircraft receiver and transmitter, designed primarily for "radio beam" instrument flying, has been installed and proved satisfactory. Simplicity in changing to the desired frequencies while in flight is obtained with this set, the conversion taking less than three minutes.

For example, the local department of commerce weather forecast for pilots is broadcast on 224 kilocycles, while the sheriff's radio station uses the 2,490-kilocycle band. An exchange of one compact bank of receiver coils in the receiving set is made and with the proper dial adjustment to 2,490 kilocycles, the pilot then receives the sheriff's calls from the radio cars as they are "fed back" through the main station microphone, situated in front of the station receiver. The plane trans-



mitter conversion is made with an exchange of one transmitter induction coil and a dial adjustment of the lining condenser, tuning the transmitter to the proper frequency. No change is necessary in the radio cars and they transmit and receive in the orthodox manner.

Conversation is carried on between pilot and radio-car officer, the pilot directing the car over hazardous roads, advising cutoffs to be made by the car to head off fugitives, or to direct officers on the ground in rescue work or searching parties. Radio-car officers are able to talk to the plane, requesting any needed information.

During a recent flood, a marooned family in the Tijuana river was located by the sheriff's plane. The family's position was radioed to rescue parties on the banks of the mile-wide river, whose view

(Continued to page 155A)

Top, pilot ready for reception and transmission. Center, numbers on squad cars aid the pilot. Bottom, receiver and transmitter in plane. Exchanging coils adapts equipment for police broadcast band

gging coils adapts equipment for police broadcast band

Speeding Model Autos Thrill Racing Fans

Latest thrill for the racing fan is that experienced in watching model autos speed along a miniature track at a pace of forty miles per hour. The small speedsters, weighing four and one-half pounds, are replicas of noted racing cars. Each is propelled by rubber bands. Pillows are used to stop the little automobiles.

Center, ready for the starter's flag. Top, pillows halt the cars and end race. Bottom, preparing one of the cars for a race.



Black Radiator Saves No Fuel but Gives More Heat

Heating-plant radiators may be painted any color without running up the coal bill, according to Cornell University experts. A black radiator will radiate more heat than a red one. A white radiator radiates the least, about twenty-five per cent slower than the black. It is a seeming paradox that this makes no difference in fuel bills. If a radiator is painted so that it emits heat more rapidly, it will cool off that much more rapidly, unless additional heat is continually supplied. If the furnace supplies a certain amount of heat, the white radiator might take an hour to emit it into the room, and the black radiator only three-quarters of an hour. The amount of coal burned would be the same.

Printing Type Made of Plastic Can Be Remelted for Use

Plastic printing type has been developed in practical form. A ~~Leipzig~~ Germany, printing firm succeeded in making movable type from a plastic known as Polystrol. The new material is much lighter than lead and zinc and can be remelted and used over and over again!

Christian Science
March 3/17/38

Deutscher Verlagsgesellschaft
Leipzig

Reported by German
Consul at Leipzig

Aerial Mailbox Is Driven by Electric Trolley



Instead of walking the equivalent of a city block to his roadside mailbox, R. H. Bess of Downey, Calif., throws a switch on the front porch and the mailbox travels up to the door on an aerial cableway. An old sewing-machine motor in the top of the box drives it, picking up power from two suspended wires connected with the house electric circuit. The four wheels of the mailbox, which is made of wall-board for insulation, run on the wires, hung from poles erected on a direct line from porch to road. Forward and reverse gears permit two-way travel. A red light on the roadside post lights up when the box arrives there, signaling for the operator to turn off the current and halt the box.

The mailbox of R. H. Bess at Downey, Calif., is really an electric trolley car. In the center it is seen traveling its aerial cable route from roadside terminal (upper right) to bring mail to front door, below

Luggage Bag for Top of Automobile Has Large Capacity

Having a capacity of eleven cubic feet, a baggage carrier for the top of the automobile is handy for the tourist. The bag is sixty-two inches long, twenty-eight inches wide and thirteen inches deep. It has ample space for suitcases, bags, parcels, guns, fishing tackle, golf clubs and other baggage. Freshly cleaned and pressed garments may be carried without folding. The carrier may be installed on the car's roof in three minutes or removed in one minute. Stormproof and made streamline to reduce wind resistance, the bag fits the roof closely to eliminate friction and to prevent scarring. A separate bag, triangular in shape to fit into the streamline contour of the front of the other bag, provides space for odds and ends.

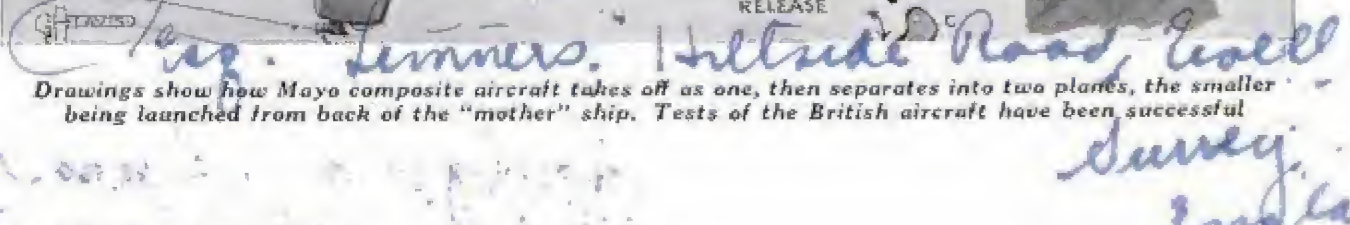
Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.



Top, luggage ready to be packed in car. Bottom, packing bag on top of the automobile

Can make for other
in order
Made by W.A. Rush,
Arcade Bldg. Beatrice, Neb.

*Adm. Mayor J. N. Mayo Q 136.
P. A. S. Technical adviser*



Drawings show how Mayo composite aircraft takes off as one, then separates into two planes, the smaller being launched from back of the "mother" ship. Tests of the British aircraft have been successful

Giant Floating Bridge to Carry Lake Traffic



Sketch of the floating bridge. Inset, movable span drawn back. Arrows mark direction in which span is moved

Designed to carry four lanes of automobile traffic across Lake Washington at Seattle, a giant floating bridge is planned by the Washington State highway department. Because of the lake's depth of more than 200 feet and its soft muck bottom of fifty to 100 feet, engineers recommended the floating bridge as the only practical method of spanning the lake. The bridge will be 8,733 feet long, of which 5,671 feet will be composed of floating concrete pontoons, connecting Seattle on the west with Mercer island near the east shore. Each pontoon will be sixty feet wide and 310 feet long, with a draft of ten feet and a height of six feet from water line to deck. The concrete shell will be eight inches thick with six-inch intermediate walls dividing the pontoon into eighty sections. The pontoons will be anchored to concrete "dead men" in the lake bottom and connected so as to allow expansion and contraction of the concrete, but prevent vertical action. Engineers say there will be no appreciable movement, even under the most unusual conditions. Three or four wider pontoons will permit parking of automobiles without interfering with the flow of traffic. One feature of the bridge will be a 200-foot movable span that may be drawn back

into the structure to permit passage of large ships. Small craft will be able to pass beneath the bridge near the shore where approaches will have a horizontal clearance of about 150 feet. Articulation of the approaches with the first pontoons will be accomplished through water ballast kept at proper level within the pontoons by automatic electrically driven pumps.

Bulk Film Winder for Camera Loads Strip in Daylight

Miniature camera owners can make use of the low-priced bulk film by loading it with a daylight film winder. It holds a 100-foot roll of bulk film, which must be put into the winder in the darkroom, but the transfer of ten, eighteen or thirty-



six "frames" into the camera can be made in daylight. This winding device is dust-proof, and eliminates any danger of getting fingermarks or scratches on the film while it is being loaded.

Hourlydale Stamps
Waltham, Mass. Hourlydale, Pa.

Carl Emile C. Schürmacker

#341 727 Park Ave. New York City.

NEWSPAPERS that TALK

Pat. # 2,063,890

"HURRY to Police Headquarters with the sound box. Get every word of that murderer's confession so our readers will be able to play it tonight when they see the pictures!"

Such assignments may become routine to the newspaper reporter and photographer of the future who will carry a portable recording device when he covers an important story. Every word of sound will be recorded on a film



Top and bottom, cutting out sound track and pasting it into strip for reproducer. Center, typical sound feature page from which sound track would be taken

track which will be rushed to the newspaper office to be developed and printed. When the newspaper is bought that evening, it will have not only pictures and type matter but also a series of wavy lines constituting sound tracks, along the margin and, in some cases, on the page itself.

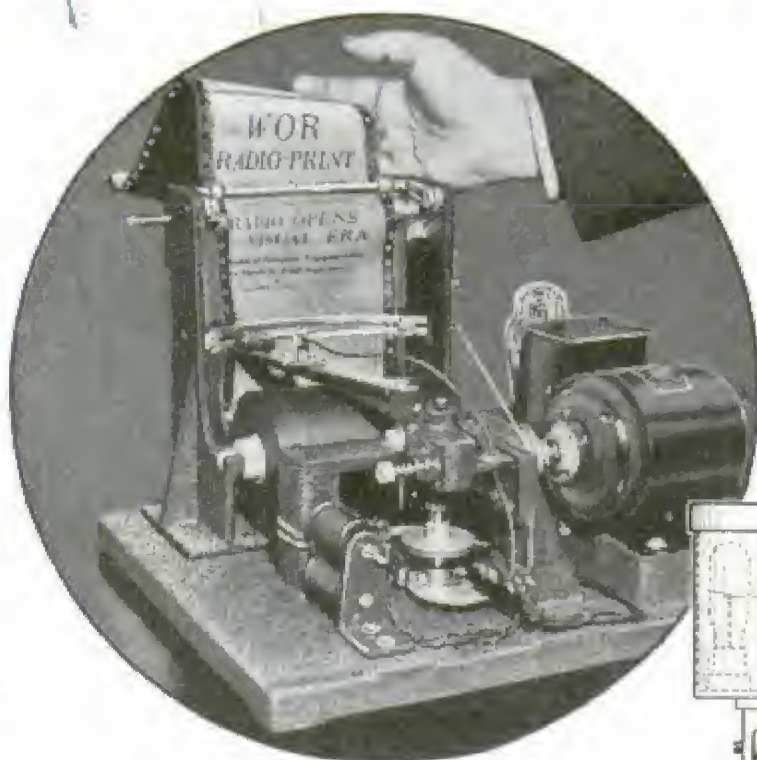
Cutting these sound tracks apart and pasting them together in a continuous strip, the reader will put them in an inexpensive reproducing device attached to his loud speaker. Then he will hear the murderer's confession—his children will hear the comic characters in the funny section talk, bark, quack and mew, and his wife, reading a travel article about Hawaii, will hear the soft accompaniment of guitars and ukuleles providing appropriate atmosphere.

Such will be the talking newspaper of the future as visualized by W. G. H. Finch, who has patented sound devices which will make possible the talking newspaper.

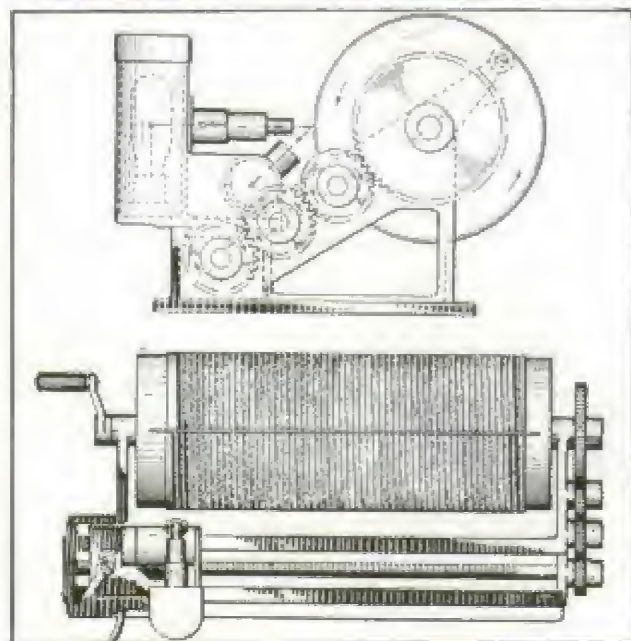
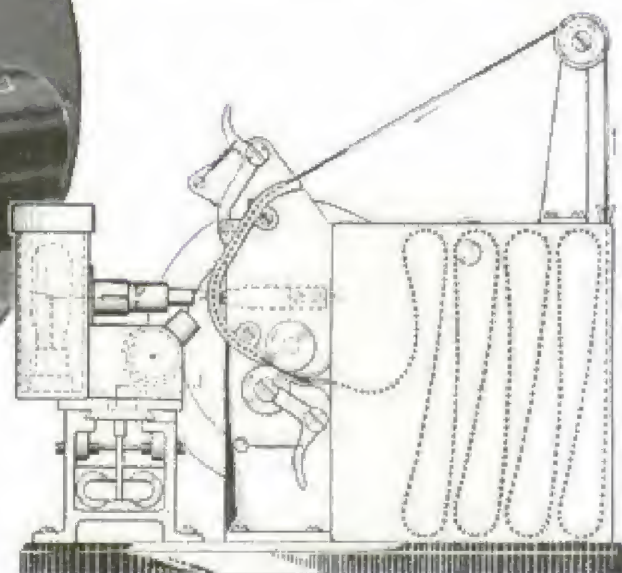
Repeated requests of young children to "please read me the funnies" and the desire to find a means whereby the blind could "read" a newspaper without setting it in Braille type were responsible largely

Telecommunicating Laboratories
37 W. 57 St. New York

see March 1937 - 377



Left, facsimile recorder by which pictures and reading matter may be taken from the air and reproduced in home. Below, diagram of home reproducer. Bottom, another type of reproducer which handles sound track in spiral form



for the invention of the talking newspaper.

"The printing of the sound-track strip upon the newspaper itself is similar to the printing operation of any picture in the paper," Mr. Finch explains. "A zinc plate is made from the original sound track and the steps of printing a facsimile of the sound tracks upon the sheet is similar to the well-known practice.

"I prefer to provide perforations upon the border of the strip to define and simplify their removal more accurately. Although a single length of the strip may be employed for reproduction of the feature, modifications are provided whereby a series of strips are attached end to end to form a continuous belt of the sound tracks.

"A further modification employs sound tracks, arranged at an angle to the sheet, which are formed into a cylindrical sheet for reproduction whereby a continuous helical scanning operation is used for the reproduction. This modification may take the form of either a strip or sheet record."

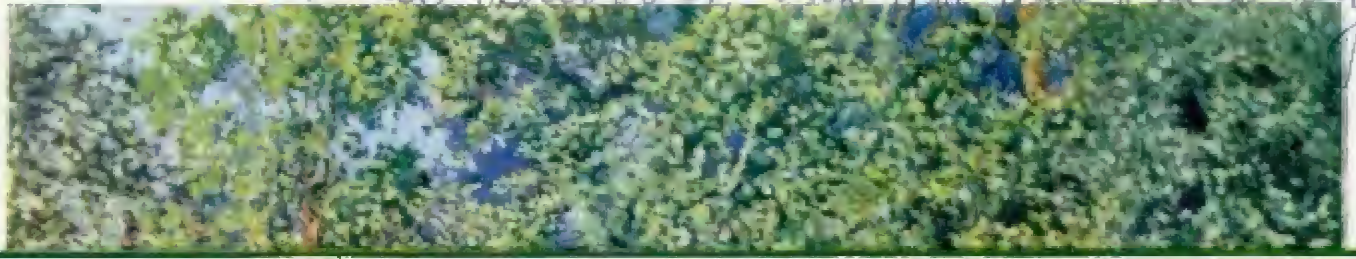
According to Frederick Ehlert, Mr. Finch's associate, the home reproducing equipment may be sold for a surprisingly low price. A newspaper that adds talkies to its printed words may purchase a master recorder for \$1,000 to \$1,500. As the editorial talkie assignments begin to cover sensational news and features not recorded in the office, portable recorders will be added for reporters and photographers to

carry, just as photographers for news picture services now take picture-sending devices, enabling them to wire their pictures back to the office.

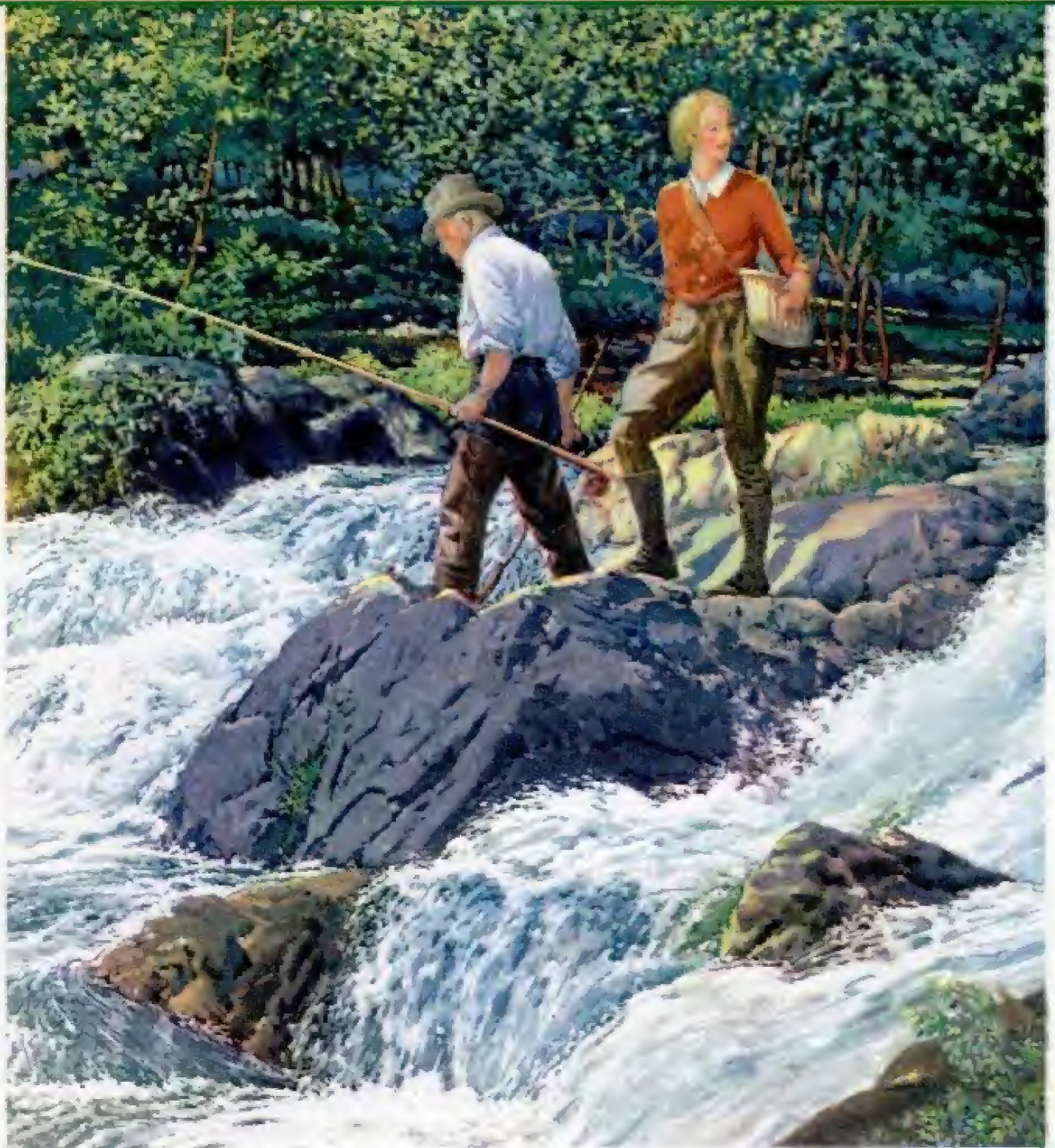
Mr. Finch foresees the need of a similar service and intends to try sending facsimiles of sound waves. If this proves practical, it will be possible for a newspaper photographer and reporter covering an earthquake in California to send to a New York newspaper, by radio or telephone,

(Continued to page 153A)

251,550 Cont. Charles Morrow Wilson
Hotel Brevoort, 5th Ave and 8th St New York



DON'T PITY *the* POOR FISH



COLD, swift water like this with a temperature ranging between fifty-five and sixty degrees is ideal for trout.



DON'T be surprised when you catch a trout with a "calling card," an identification tag attached at the hatchery.

By Charles Morrow Wilson

THERE is no longer any need to pity the "poor fish" because today there are fish with calling cards, fish doctors, surgeons, and dieticians, water-conditioned buses for fish, trout engineers and architects, fish elevators, modern rest rooms or pools for trout and home-coming days for wandering salmon.

These are a few of the piscatorial wonders which meet the opening of what will probably be the greatest angling season in history. Taxpayers are handing out tithe to trout whether they fish or don't fish. Each year anglers pay about \$100,000,000 for fishing licenses, rods and tackle. But that's only part of the story.

Federal and state governments now maintain about 469 trout hatcheries or rearing stations in thirty-one states.

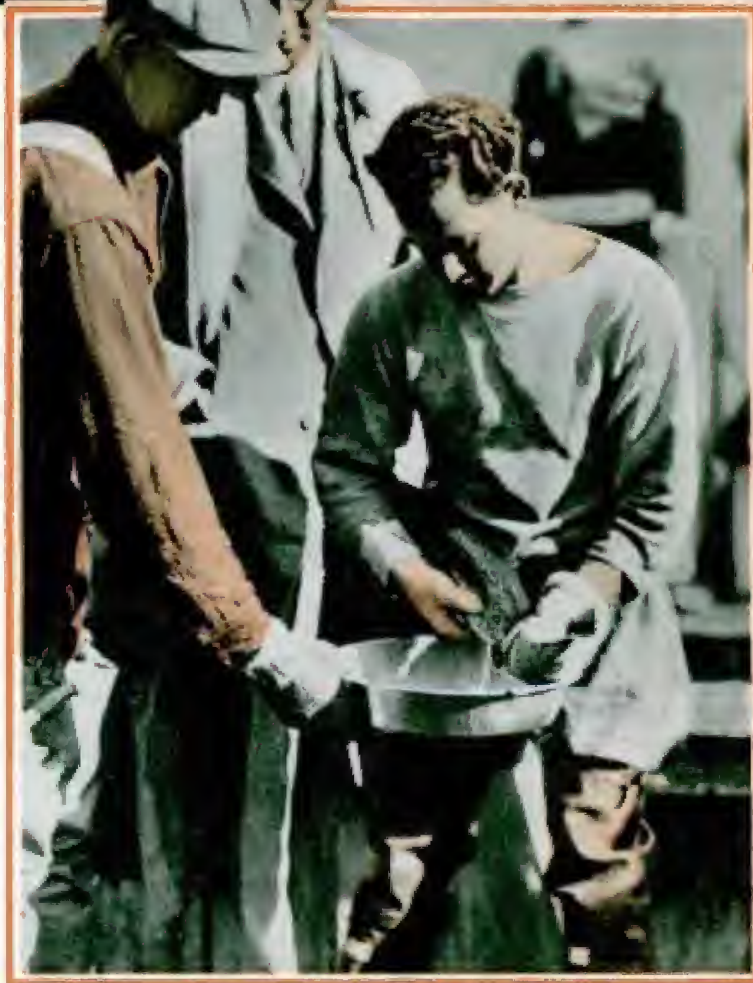
Public money pays for these and the fish produced are planted in more than 91,000 fresh-water rivers, streams, ponds and lakes. Private trout-growing establishments have become a \$50,000,000 industry.

Maine, with more than 7,500 inland bodies of water, now leads the world in state rearing and hatching of trout. Maine's cash income from trout fishing is estimated as \$30,000,000 a year. In order to keep up this resource Maine operates fourteen trout hatcheries and twenty-six rearing stations to raise and "plant" about 20,000,000 trout a year—supposedly enough fish to supply the maximum catch to 4,000,000 anglers. The trout average about five inches in length, minimum catch size, when taken from the rearing pools. Production cost is about one cent an inch.



Modern hatcheries produce good minnows from seventy to eighty-five per cent of the eggs. In natural surroundings only ten to fifteen per cent of trout eggs ever hatch. Trout hatchery losses of minnows from disease and suffocation now average about five per cent. Natural losses from these same causes are thought to be about fifty per cent. Carl H. Crane, directing architect for the Maine trout stations, is perhaps the first to earn the title of professional fish architect. Both our government and Canada have requested permission to copy his designs, which include five-million-egg hatcheries and more than thirty miles of sand-bottom spillways.

Dr. E. B. Mann of Maine University is probably first to rate the title of physician and surgeon of trout. He supervises trout health and sanitary conditions, isolates contagious trout diseases, and directs autopsies on fish which die in the rearing pool. Hatchery-raised trout are far healthier than the native or "wild" fish which are the principal source of disease.



8/1

essay.
STRIPPING eggs from fish for later hatching. State trout hatchery in Maine, above, where about 5,000,000 trout are produced each year.



A SALMON like this is a worthy foe for any angler. Top, the government and the various states spend millions each year to further this sport.

Trout dieticians are extremely busy selecting the right vitamins for these fish. In earlier days, ground liver and wheat bran were thought to be an ideal feed. This ration is now largely discarded.

The modern menu for trout starts the young minnows on a straight diet of ground beef and pork liver, followed by ground beef heart and "melts" and salmon egg meal, imported largely from Japan. Protein content must be high—from twenty-two to twenty-six per cent of volume—the fat content must be low, and the water content must be at least seventy per cent of volume.

Feeding baby trout the modern way is more detailed and exacting than feeding human babies. After three months the ration begins shifting to sea foods. The trout is a cannibal by nature. He grows big by eating smaller fish. Heretofore it had been thought that no fresh-water fish could thrive on salt-water fish. Modern trout dieticians are disproving this belief. After the third month the ration includes such seafish as whiting, cod, sole, and herring. These are ground or chopped.



The seafood ration grows a five-inch trout in nine or ten months. Successful use of seafood for fresh-water fish is of particular interest to naturalists. Some believe it indicates that all fish life came originally from a salt-water source and that by degrees certain salt-water fish may be adapted to fresh water for the benefit of inland anglers. The salmon which, next to trout, is our most valuable fish, is an instance of a great sea crop which migrates hundreds of miles to spawn in fresh water, often far inland.

Modern quality standards for trout feeding puts the average commercial restaurant or hotel to shame. Sea fish must be iced on the fishing boats and as soon as the boat is docked they must be transferred to refrigerating plants where the food is frozen and held at sub-zero temperatures until feeding time. Beef and other animal meats must also pass the standard packing inspection and remain closely covered in cold storage until use. Maine now owns and operates a modern refrigeration plant for exclusive use of the trout crop.

Mr. Trout is subject to more respiratory diseases than



TRANSFERRING trout from oxygen-charged tanks on truck to Maine lake after checking to see that tank and stream temperatures are the same.



814
TRAPPING fish, above, to be used for breeding purposes. Right, spillway system at Maine trout hatchery.

dry mulls

a human and to contagions which can destroy an entire trout population within a few days. So fish physicians are studying problems of temperature and channels. It is now a known fact that trout do not thrive in water with a temperature higher than sixty-eight degrees. But fifty-five to sixty degrees is the ideal trout temperature, and winter and summer averages should never vary more than five degrees. This is why the best trout streams should be fed by numerous surface springs which are nature's own thermostats.

So here's a good trout-catching tip. When you go fishing, take a liquid thermometer and check stream temperatures. Also remember that a trout judges bait or tackle more by color than by odor or taste. His eye is his best developed organ.

Many trout diseases and infections

257530
seem to result merely from warm water, or abrupt changes in stream temperatures. Expert nursemaids to trout are therefore never without thermometers. In taking trout from the hatchery to open streams workmen first check the temperature of the tank in which the live fish are shipped, then check the temperature of the open stream, then heat or cool the tank until the two temperatures check.

State fishery departments of Wisconsin, Michigan, and Maine, co-operating with the U. S. Bureau of fisheries, use a type of oxygen-tank truck for transporting planting stock from hatcheries to streams. These trucks carry a central tank made up of from twelve to twenty watertight cylinder berths which are made of non-tarnishing metal and connected with overhead oxygen hoses.





Oxygen chambers are stored at the base of the tank and a compressor attached to the truck motor keeps fresh oxygen circulating continuously in all vats.

In this way the planting stock can be shipped for several hours without suffocation losses, which would otherwise be ruinous. But there is still demand for improvement. Chunky, highly muscular fish such as bass, literally pound themselves to death in their anxiety to break free.

Oxygen is at a premium with trout and with practically all game fish. Rapid currents and small waterfalls tend to keep up the oxygen content. This introduces the rest room for trout. At the base of each spillway in the new-style rearing station is a pool of quiet water where the trout can "linger a while" before taking the next lap upstream. It has been discovered that a continuous strong current can literally tire a young trout to death.

Trout experts are now returning to natural sand bottoms for spillways and rearing pools. There's no cement channel in Maine's new super-stations for trout. Spillways are dug in native sand



SELECTING fish to be used for breeding purposes at a hatchery. Above, setting a "weir" to trap wild trout for later propagation at a state hatchery.

9/1550

876



ONE of the 92,000 rivers and streams of the United States now being stocked with game fish from either federal or state hatcheries.

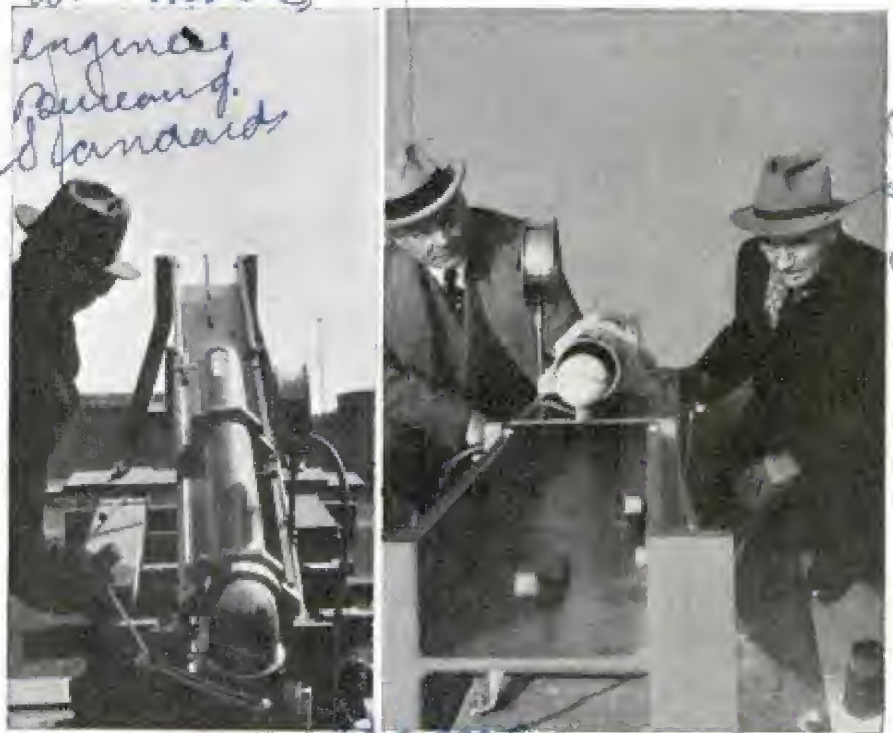
and gravel and fed by surface springs. Systems of gate-locks keep trout of approximately the same age and size in a given spillway—about 5,000 fish to the "block." This prevents cannibalism.

The earlier practice of stocking trout streams with fifth-stage minnows or "fingerlings" is also outdated. Experiment has proven that such planting does

little more than provide the adult trout with a good meal. The five-inch size, however, succeeds reasonably well in taking care of itself in open water, particularly when planted in the spring-time. Experts believe that about sixty per cent of possible trout streams of the United States are now contaminated by sewage or (Continued to page 128A)

Mechanical Batter Tests Liveliness of Balls

There was no cheering from crowded grandstands when the first home runs of the year soared over the center field wall. A baseball "cannon" was the batter. The American and National leagues wanted an accurate check on the relative liveliness of the official baseballs, and the U. S. Bureau of Standards devised a mechanical batter to make the tests. It smacked a couple of balls more than 530 feet. The series of tests proved that the National League ball was quite as lively as the American League ball.



Baseballs are the bullets fed to this cannon, developed at the Bureau of Standards to test the liveliness of balls used in the big leagues this year

Boy's Hobby of Bottling Snakes Pays Way through School

Six years ago a Chicago schoolboy began collecting snakes, frogs and insects. He did it purely as a hobby at first, hunting the specimens and preserving them. When



This Chicago schoolboy made a paying business of collecting and preserving animal specimens for sale

he entered high school he found there was a market for these preserved specimens in schools, colleges and scientific institutions, and he began selling them. Later he added animal embryos to his stock, obtaining them from the stockyards, and now he has banked enough money to pay for a college education and is earning his living at what used to be his hobby.

Sky Liner Contains Ton of Steel Despite New Light Alloys

Construction of today's giant air transports has gone hand in hand with the development of light alloys, but steel has by no means been eliminated. More than seventeen per cent of the basic weight of the big planes consists of steel. There is about a ton of steel in the twenty-one passenger liner, appearing in more than a score of alloys. Aluminum and magnesium find increasing uses in the airplane factories, magnesium alloys going into landing wheels and engine parts. As much as 150 pounds—the weight of a passenger—can be saved by using magnesium alloys in the landing wheels of the largest planes.

Samuel Sankin
3444 Ar. Rd.

How Chemical Co.
Midland Mich.

H 3 2 0
McNamee headquarters
220 E 42nd, New York
photos.

The LATEST



tion room. One scene showed an airplane landing on a plantation field after dark and then taking off again.

"That's real," the aviator decided. "It was made with a real airplane because you could see what the pilot was doing. Did you notice how he leveled off too soon for his landing and then nosed down again? And on the take-off, how the wing tilted over and he corrected it with his stick?"

"Sure, I did," Fulton answered, "and believe me, it was hard to get those little touches of realism into the picture. That airplane was really a four-foot model moved by invisible wires that also carried the current to blink the lights and spin the motor. We handled the airplane like a marionette on strings. All

AT THE movies a few years ago you saw many scenes so crude that you could tell they had been filmed in miniature or by some other trick process. Today more scenes than ever are being manufactured instead of acted, but audiences rarely can pick them out. Motion-picture trick men are fooling the experts.

Recently naval aviators were discussing trick work with John P. Fulton, motion-picture special effects director. One of them declared that he could spot fake airplane shots by little flaws apparent to any flyer.

"All right," Fulton said, "let's see how good you are." From the studio's film library he obtained a print of "Wings Over Honolulu" and had it run off in a projec-



Top, filming miniature plane gliding into water out of control. Bottom, dummy to be used in filming delayed parachute jump

MOVIE THRILLS



the scenery that you saw was made to the same scale and we put the camera lens right down on the ground to get the right perspective."

Another scene showed an amphibian, out of fuel in the fog, crash into a wharf while making a forced landing. The aviators held their breaths when the plane crashed and then decided that the studio had hired

a stunt pilot to wreck the plane. But, Fulton explained, it was far too dangerous for a stunt man and besides, there wouldn't be enough light in a real fog for the camera to record the crash. The amphibian was another model. Before the picture was filmed parts of the airplane and parts of the wharf were broken off and then lightly glued back into place. When ev-



Top, preparing model ship for wreck scene in tank. Bottom, left, movie of ocean used as background for beach scene. Right, set complete except for ocean, which is provided by movie projected on background screen covering black area

Reference: John D. Fulton's movie 'The Airplane' 1521



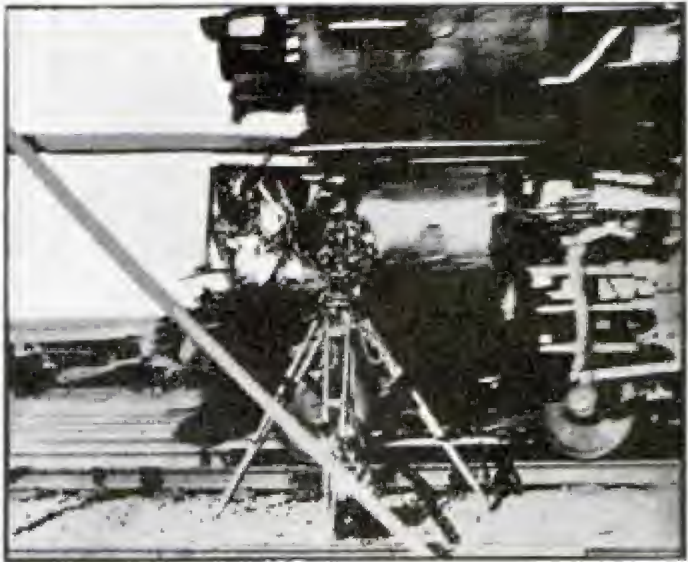
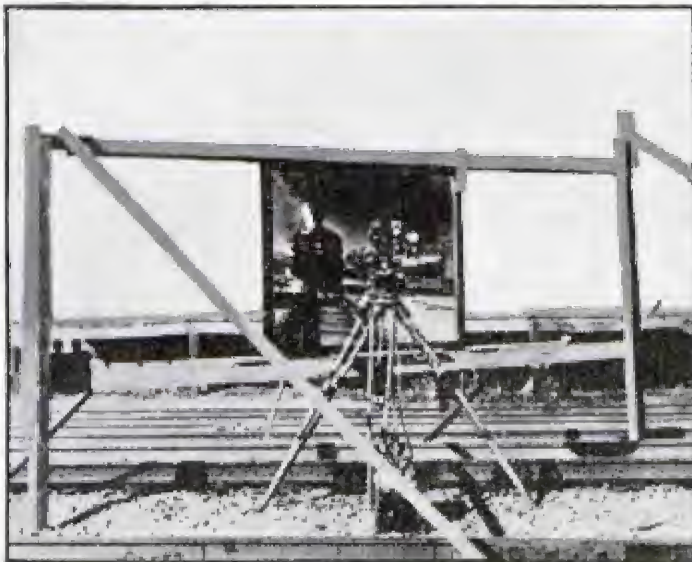
everything was ready, men on an overhead carriage lowered the miniature amphibian into the scene by its wires. To the camera it looked like the pilot was circling down through the fog to the water.

Fulton wanted a realistic crash but the wires holding up the plane interfered with it, so he stretched another thin wire across the flight path, charged with the same current as the wires holding up the plane. The short circuit that resulted when the wires touched blew out a fuse inside the model, releasing its suspension wires and allowing it to continue its glide in free flight. That let it crash into the wharf realistically. The "break-away" parts and timbers flew into the air and then the plane flipped over on its back in the water exactly as planned.

Trick work is necessary in pictures because many scenes would be impossible to catch otherwise. Another airplane picture called for a close-up shot showing the crumpling of a big transport's landing gear as it came in contact with the top of a telephone pole. To do that in real life would mean wrecking a big airplane, yet Fulton produced a perfect picture in a couple of days. On the floor of a stage he erected a small telephone pole and beneath an overhead carriage that traveled past the pole he constructed an airplane landing gear, wheel and part of the wing. Everything was built to one-quarter scale. An automatic camera was tied to the overhead carriage and the carriage was moved across the stage at twenty-five miles per hour. The wheel crashed into the top of the pole, splintering the pole and damaging the landing gear, and the crash tripped the locks that held the carriage in the



Left, top to bottom, strip showing how composite motion picture is created by using parts of a number of different scenes. The bottom scene is the composite. Right, preparing to film take-off of miniature plane controlled by overhead wires



air. The whole assembly fell to the floor where the landing gear crumpled up and broke, just as it would have on a real airplane. The camera caught every detail.

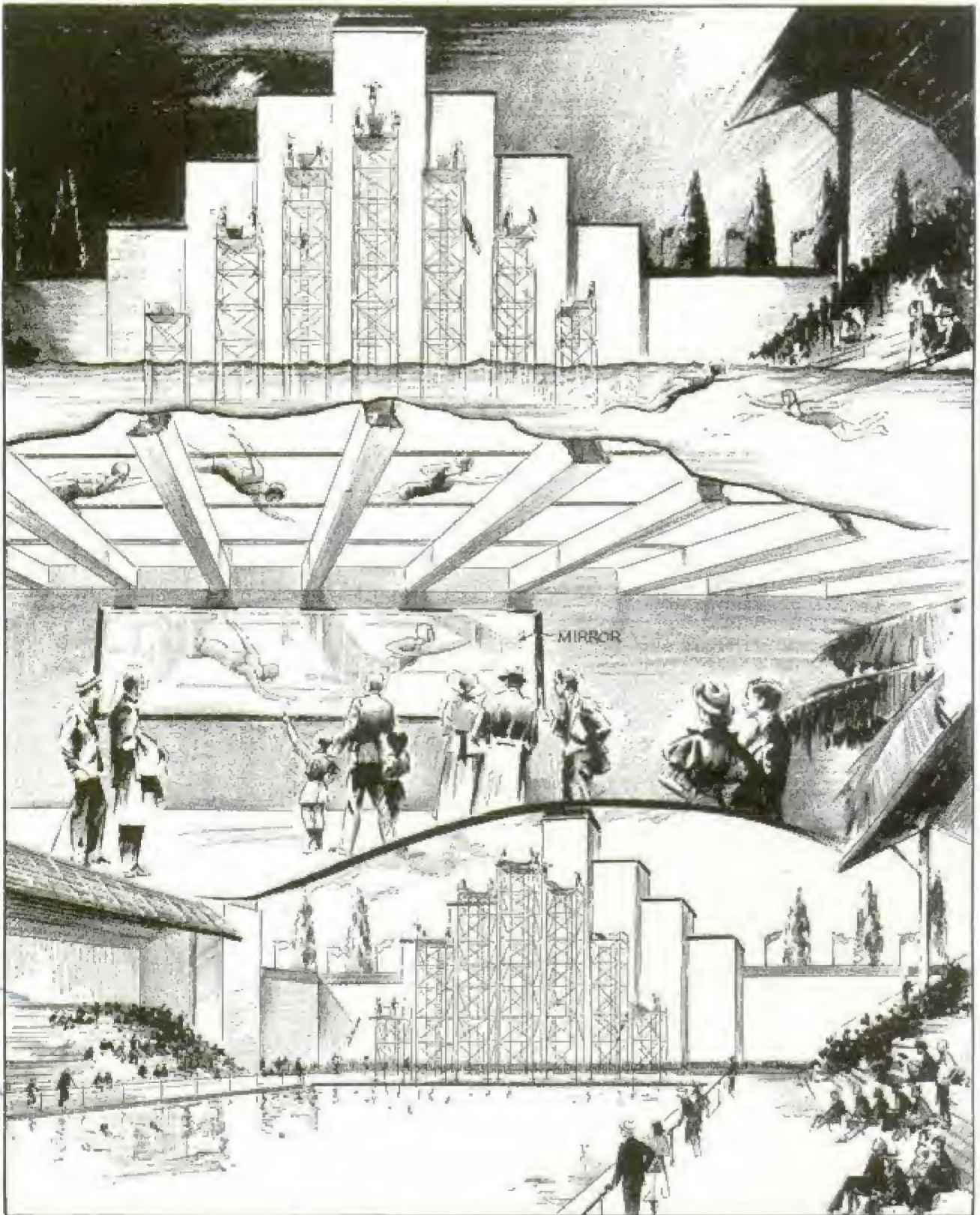
Crashing an airplane or sinking a ship sometimes is best done with models but other times full-scale sections are built and rocked on the stage while actors go through their work. Some scenes that you see on the screen are composites manufactured in the laboratory by joining together parts of scenes taken from different strips of film. A good example appeared in "The Road Back." The script called for a scene showing part of a German town, with a train passing under a bridge in the foreground. To have built the full set would have cost much more than the scene was worth, so Fulton created it by combining five different strips of film. One strip was made of part of a set showing a street and buildings. Frame by frame, all of the scenery in the film



Top, two views showing how locomotive is filmed close up with mirror. Center, spectacular crash of two miniature planes. Bottom, realistic appearance of planes after crash

(Continued to page 132A)

Glass Swimming Pool Has Windows in Floor



Underwater galleries will permit spectators to watch diving and swimming exhibitions from beneath the pool to be built at the San Francisco fair in 1939. Diving towers will have springboards of plastic glass

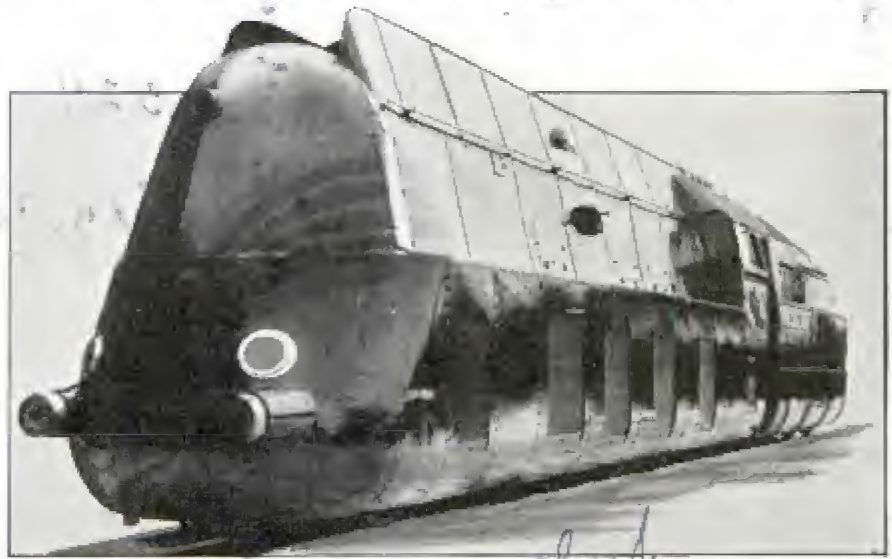
Visitors to the glass "swimming bowl" planned for the Golden Gate exposition in 1939 will watch speed stars and divers from beneath the windowed floor and from gal-

leries along the sides of the pool. Six-foot square panels of glass an inch thick will form the bottom, and tilted mirrored walls will allow full vision of the tank above. The

585 Bush St. San Francisco, Calif.
 Architect - Mark Hammett, San Francisco

entrance foyer will be under the shallow end of the pool. From there the visitor proceeds to the mezzanine, with its observation galleries providing a view under the water through glass panels five feet high and sixty feet long. The pool itself will be fifty-five by 110 feet, fourteen feet deep at the diving end. There will be five towers and seven diving boards of plastic glass which must meet all the standard requirements for intercollegiate diving events. Even the backdrops behind the diving platforms will be made of glass, dramatically lighted by neon tubing. There will be seats for 2,000 spectators, who can be protected from rain by a movable glass roof.

Streamline Rail Speedster Latest on Foreign Railways



Latest of the foreign-made streamline locomotives. Note how the wheels have been covered and the pilot eliminated

Constructed with the smoothly flowing lines of many locomotives in the United States, a giant locomotive was placed in operation recently in Czechoslovakia. A hood or cover conceals practically all working parts, giving the locomotive a streamline appearance. This is the first streamliner to be put in service by the Czechoslovakian State railway.

Shaded Light on Car Sun Visor Aids in Reading Maps



Ease in reading road maps at night is afforded the motorist by an electric lamp attached to the sun visor of the car. The light is controlled by a switch on the instrument panel. Shaded to direct illumination where desired, the lamp also is a convenience to the woman driver in arranging her hair or applying cosmetics.



Two views of sun visor light in use. Its rays can be directed by moving the sun visor

Shooting Gallery Uses Movie of Game as Target

Original motion-picture film showing game in the forest is used in a shooting gallery introduced in Germany. The device is so constructed that when a shot is fired, the film stops and a bright light appears where the bullet hit. The film targets are being used by police and army shooting schools.

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

W. Herman L. Hallup

530 Leader Bldg. Cleveland Ohio

International Hunting Exhibition Berlin

Grip on Hoist Holds Auto as Service Man Works



Top, showing how firmly auto is held. Bottom, preparing to hoist the car

While the automobile is elevated on the lubrication or servicing hoist, it may be held safely by a new gripping device. After the car is driven on the hoist, the clamps or jaws of the grip are turned up and clamped on the rear axle. A long-handled crank is used, making it unnecessary for the operator to crawl under the car. When the hoist is raised, the automobile may be rocked with a pry bar, in forcing grease through bearings and springs, without danger of the car falling.

Plane Image on Dial Shows Pilot Position of Landing Wheels

Glancing at a picture of his ship on its own instrument board, an airplane pilot can see the exact position of his landing gear and wing flaps. This latest type of dial outlines the plane in white against a

black background. As the pilot approaches an airport and lowers the wheels and flaps to landing position, the wheels and flaps of the phantom plane on the indicator follow an identical course and the pilot can visualize their position.

Hand Tool Pulls Railroad Ties Like Opening Desk Drawer

Railroad ties are pulled out for replacement today almost as easily as you pull open a desk drawer. Instead of the old method of digging out the roadbed, lifting the rail and removing the tie, a hand lever operated by one man does the job without disturbing the track. It is butted to the lower part of the rail, and a set of bull teeth bite into the tie. When the lever is pulled on a pawl ratchet system the tie is drawn out, leaving a clean hole into which the new tie can be slipped, and only the spikes and plates need to be replaced.



Cable Car Rides above Flood in California Canyon

Floods may come but rarely in the canyons that empty into the San Fernando valley of California, but there is always a



Crossing the flooded Big Tujunga canyon above Sunland, Calif., in cable car well protected from rain

cable car ready for emergency crossings when high water hits the Big Tujunga canyon above Sunland. With a raging river below and a torrent of rain overhead, it is still snug and dry inside the glorified "breeches buoy" swinging across from bank to bank with passengers.

H 325 Slate Cutting Tool Speeds Work of Roofers

Roofing work is simplified and speeded up by a new combination slate and asbestos shingle cutter and punch. Weighing five and one-half pounds, the tool cuts roofing slate



and asbestos any length or width and cuts up to and including one-quarter inch thickness. It cuts round corners and right angles, utilizing all pieces. Any carpenter or laborer, using the tool, can cut slate on the job and place it on the roofs of buildings under construction. Little experience is necessary for handling the cutter efficiently. It is made for long wear and service, its frame being malleable iron and the knife and punch point made of special selected steel, heat treated.

Decoy Plane to Fool Enemy Is Made of Matting and Reeds



General
Japanese soldiers examining dummy airplane left by the Chinese troops

Made of Chinese reed and matting, decoy planes to fool enemy air raiders were found recently when Japanese soldiers captured Pengpu airdrome, Anhwei province, China. The dummy aircraft were intended to draw Japanese aerial bombardment away from the airport.

A 265 Tennis Game Played on Roller Skates Requires Exceptional Skill

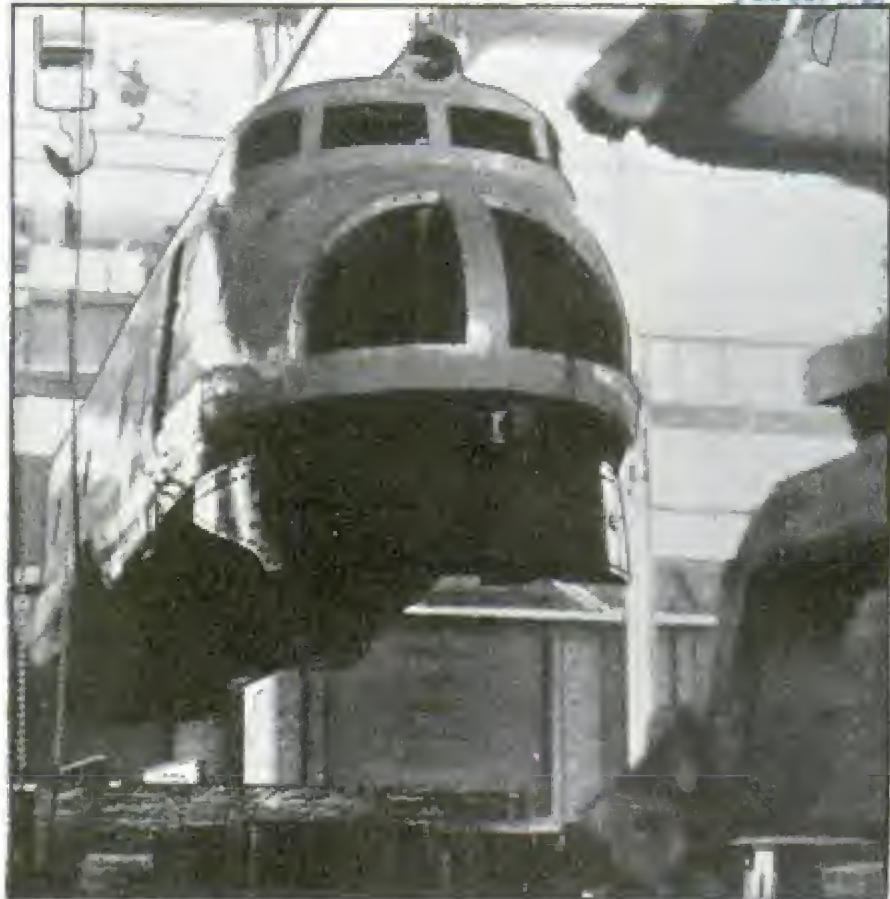
Introduced at a western college, tennis on roller skates is the latest game. Besides adding excitement to the game of tennis, it calls for real skill. Players must be able to maintain their balance on the skates and also to hit the ball as they race from side to side or from backcourt to the net.



Note that the participants in this tennis game are wearing roller skates

*Parsons Bros
Slate Co. Pen 22* *Tempe, Ariz.*

4266
 Capt. Charles Morgan Wilson
 Hotel Brevoort
 5th Ave and 8th St
 New York



The

costs as low as five dollars per kilowatt capacity. Cheap power independent of high lines and expensive copper channels.

These are some American power notes of today's and tomorrow's headline news of the new small-unit two-cycle Diesel engines which our largest manufacturer of automobiles now begins in mass production.

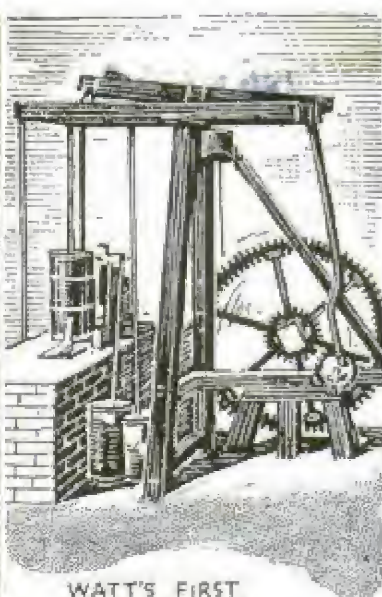
This year marks the forty-first birthday of a combustion engine invented by Dr. Rudolph Diesel, to whose doorway in Munich the mechanical world beat not only a footpath, but a six-lane boulevard. This year

TWICE as much horsepower per American. An increase of from ten to 200 per cent in efficiency of compression motors with a new accuracy of motor control. An entirely new principle of "power in a package" which eventually may cut power bills to half of present levels. Complete installation of home power units for

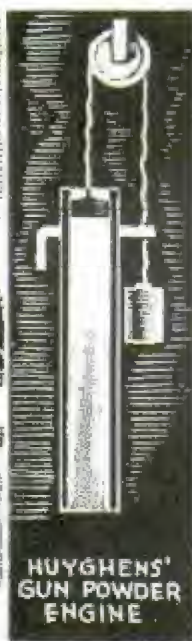
brings the Diesel hot off the assembly line, in home-sized units of twenty-two to 160 horsepower. These midget Diesels are "little brothers" of the streamline-train Diesels which have rolled up more than eight million miles of railroad service. But the new small Diesel is more than just an engine. It is a power package equipped



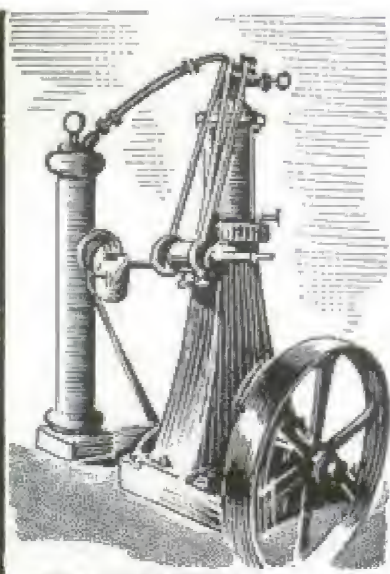
HERO'S
AEOLIPILE



WATT'S FIRST
STEAM ENGINE



HUYGHENS'
GUN POWDER
ENGINE

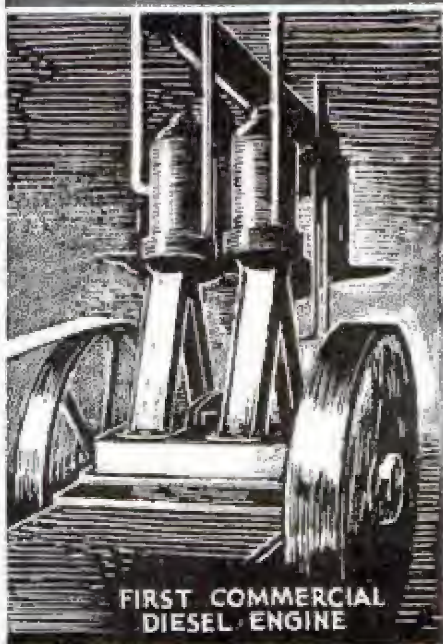


FIRST SUCCESSFUL
DIESEL ENGINE

Top, streamline power car ready to be lowered onto its trucks. Bottom, left, steam engine built by Hero in 130 B.C. Center, two other engines. Right, Dr. Diesel's first successful engine

ADVANCE of DIESEL

electro. motor cars, La Grange Ill.



**FIRST COMMERCIAL
DIESEL ENGINE**

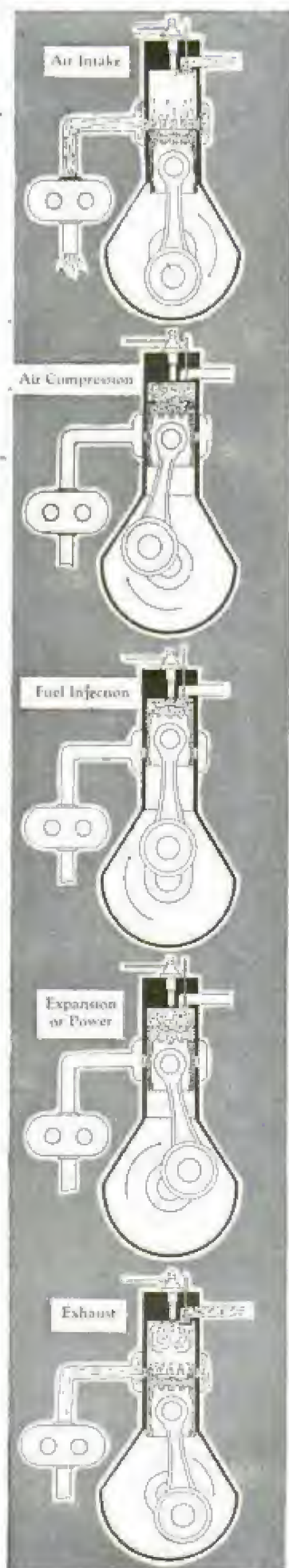
*Top, general view of plant
building Diesel engines for
railroad trains. Below, first
commercial Diesel engine*

with all accessories needed to start its job. In the case of the miniature stationary electric power plant the package includes the engine, generator, fuel-supply equipment, switch-board, etc.

A million square miles of our country are still beyond electrical service from central power plants or high lines. At least one million rural homes in the United States still do not have access to power lines. Power rates of different sections still range more than 700 per cent from a base average price. Though almost 37,000 miles of additional rural power lines have been built or contracted for in the past three years, studies made by the government show that no power-line mile which yields less than thirty-two dollars per year in kilowatt income can be a profitable investment. This limits the number of miles of copper channels which can be operated under present conditions.

Perfection of a small-unit Diesel generator suggests that in thousands of rural communities it may be possible to make electricity at home cheaper than it can be bought from power

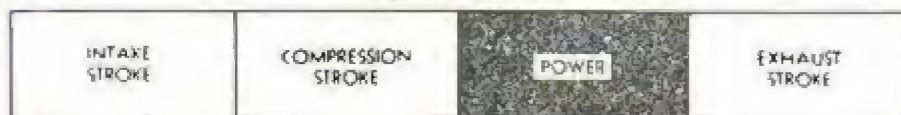
*Isuzu
Mitsubishi
Detroit
Slovak
Anyone else*



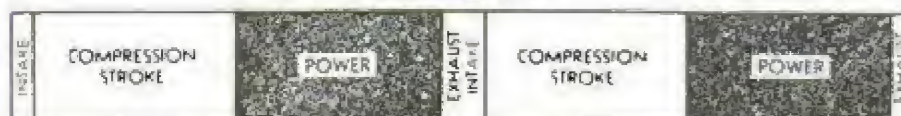
lines. Also that in remote areas power companies may be able to establish small Diesel plants to serve from one to a dozen families living beyond reach of power lines, hiring a resident farmer or workman to tend and fuel the equipment. Or an individual could install his own power plant and, if local laws allow, sell power to his neighbors.

Thus packaged power may serve to increase the uses of electrical equipment upon many thousands of farms. It may give birth to hundreds of new enterprises such as roadstands, rural amusement centers, billboard lighting, outlying theaters, parking lots, new vacation and resort projects. New progress in Diesel development unquestionably will take a still more important role in American timber industries, railroads, commercial fishing and marine shipping, as well as in further developing radio and electrical refrigeration. Almost certainly it will be of great importance to continued progress in farming, where it will power more and heavier equipment. Already city buildings are being equipped with private Diesel-generator power plants. The famous Singer Tower

FOUR STROKE CYCLE



TWO-STROKE CYCLE



Strip at left shows how the two-cycle Diesel works. Note that it has one power impulse for each two strokes of piston. Diagram, bottom of page, compares two-stroke with four-stroke cycle, showing that two-stroke cycle produces twice as much power as the four-stroke because it has two power impulses instead of one. Photo at top, "power in package" Diesel engine

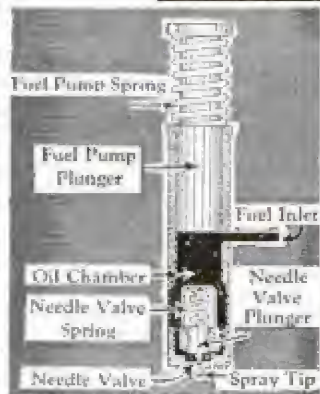
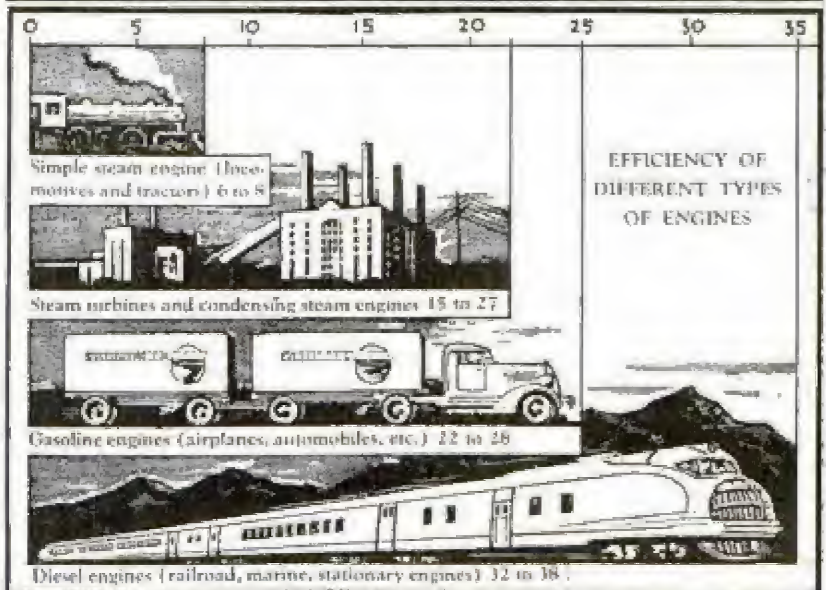
Isreen Steamend. D.C.

of New York is a typical instance.

Wider distribution and use of small generator units may have a profound effect upon our manufacturing setup. "Power in a package" gives a new advantage to the home workshop and small factory. For years many of our big industries have been breaking into smaller working units. Cheap and dependable source of power has been the greatest obstacle to this decentralization.

F. G. Shoemaker, chief engineer of the Diesel engine division of General Motors tells you that a Diesel uses less fuel per horsepower than any other practical engine known. If two engines of the same size are placed side by side, one a Diesel and the other a gasoline engine, you notice that they look much alike. The first difference is that the gasoline engine mixes fuel and air before drawing the fuel into the cylinder, while in the Diesel fuel and air are mixed inside the cylinder. The Diesel has no carburetor. Instead it uses a fuel injection system to blow or force the fuel into the compression-heated air chambers just before the piston reaches the top of its stroke.

(Continued to page 131A)



Top, view of the great Diesel plant which drives one of the rail streamliners. Center, drawing compares efficiency of different engines. Bottom, fuel injector, its essential parts, how it injects the fuel and how spray is forced out at high speed

Camera Takes "Sight Test" with Four-Color Wall Chart



Testing the camera's eye with the "vision" chart printed in four colors. It shows up errors in photographic equipment

Like the vision test cards in the oculist's office, a wall chart has been developed for checking the camera's "eye." With it you can test your camera, enlarger, lenses and filters at home, and discover any errors in the use of films, filters, exposures, developing or printing. The chart is printed in four colors, and so can be used to study color response, as well as demonstrating lens aberrations, depth of field, astigmatism, emulsion and developer characteristics and checking exposure meters.

Wildcat Drillers Get More Oil by Using Latest Methods

Modern methods of exploration and drilling have improved the batting average of wildcat drillers who search for oil in areas far from proved producing structures. Twelve per cent of all wildcat wells drilled in the southwest last year were producers of oil, gas or both, Dr. Frederic H. Lahee, geologist, reports. About one well in nine, drilled on geological information alone, was a producer in 1937, says Dr. Lahee, while the chances of getting production from a well located on geophysical evidence are better than one in four. Drillers who put down wells on a "hunch" location were successful only once in about fifteen attempts in 1937. New methods of exploring for oil, adopted

by many drillers, have reduced costs greatly. Instead of putting down a full-size hole, eight to ten inches in diameter, in exploratory work the drillers now use small holes, usually five or six inches in diameter, costing less to drill. Later, if the field shows promise, a full-size hole is drilled. Last year, with 4,096,990 feet of dry holes and 765,690 feet of producing wells drilled, costs under the old method would have been \$34,000,000, while by the new method they would have been only about half that much.

Detachable Stool on Sander Makes Work Easier

Sanding floors is a more comfortable task with the latest type sander, which has a detachable stool for the operator. The sander is adjustable for floor tilt and picks up the dust by vacuum. It can be detached from its floor mountings for hand use. A searchlight-type bulb throws a spotlight on dark corners.



Detachable seat allows worker to sand floors in comfort, and vacuum bag collects the dust

Lincoln-Schlueter
Floor Machy Co.

H 318

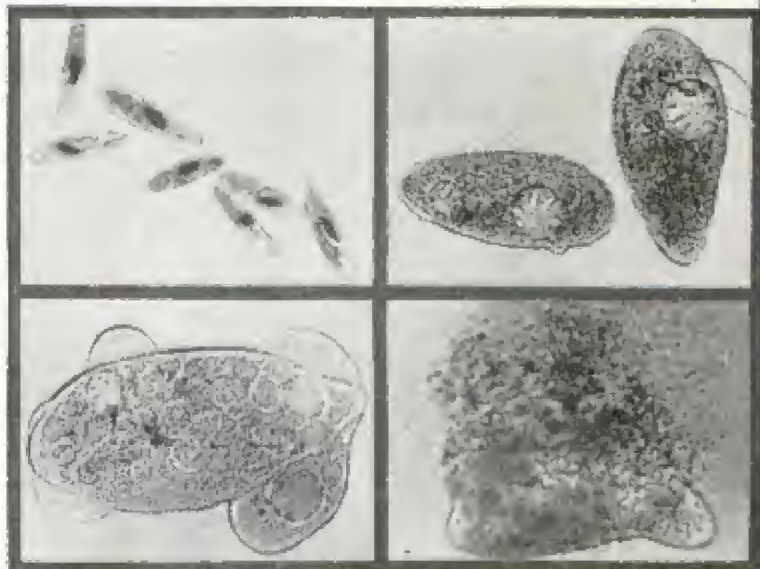
Mr. Harvey C. Kentschler
Director of Research
POPULAR MECHANICS
Westinghouse Lamp Div. Philadelphia

831

'Death Rays' Sterilize Air, Stop Mold Growth

see Seph 19 36-353

Complete sterilization of the air, food and utensils with a "death-ray" lamp is the latest accomplishment of scientists. The process requires a few seconds to a few minutes to kill bacteria within range of the lamp, at a cost of about one-third that of operating an ordinary twenty-five-watt electric bulb. The "death rays" are taken from one part of the ultraviolet spectrum and projected by the lamp. Extensive experiment revealed the deadly effect of these particular rays on microbes. Today there are experimental installations of the lamp in hospitals, banks, drugstores, soda fountains, restaurants, dairies, manufacturing plants and elsewhere. Of especial interest are the tests which indicate that the lamp may be the means of controlling epidemics of colds, pneumonia, infantile paralysis and other air-borne diseases, since its ability to destroy bacteria afloat in the air has been demonstrated. The need for a sterilizing tool of this nature has been nowhere so pressing as in surgical operating rooms, where air-borne bacteria sometimes cause post-operation infections. The variety of fields in which the lamp may be applied appears to be almost unlimited.



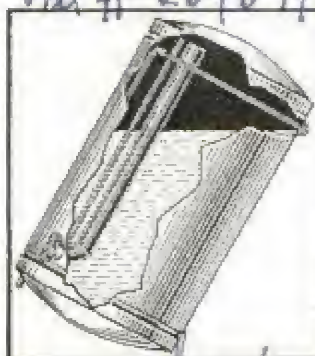
Top, white lines in display case mark location of sterilizing lamps. Bottom, steps in destruction of minute organism

H 317

Spill-Proof Gas Tank for Trucks Averts Fire in Crash

To lessen the danger of explosion and fire after highway accidents, a safety gasoline tank has been developed for trucks. Ruggedly built, with electrically welded seams, it is designed to resist battering in a collision or rupture from internal pressure. Gasoline cannot escape if the truck tips over, for the intake and air "breather" pipes both extend across the tank; tipped with the tank cap down, the pipe ends are out of the gasoline;

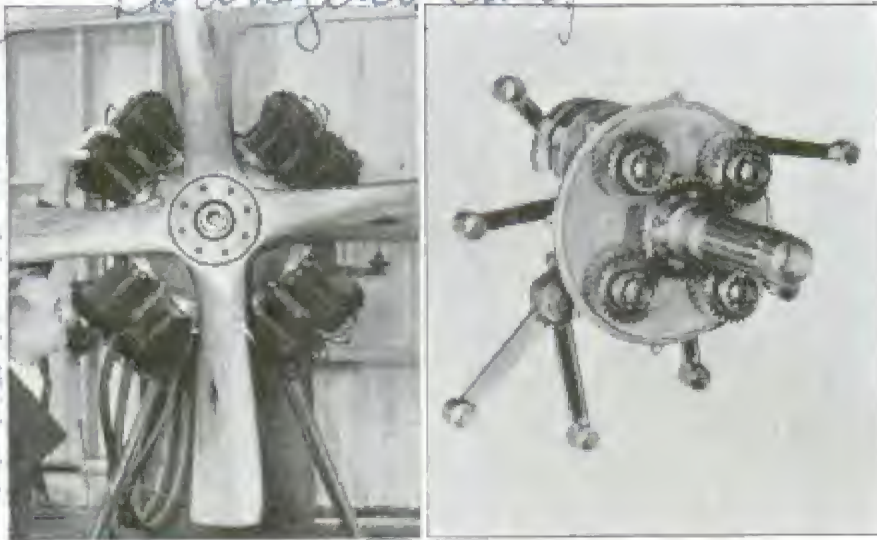
tipped to the other side, the tank cap is above the fuel; upside down, a check ball in the air vent prevents leakage. The tank cannot be filled deeper than the level of the breather pipe, and thus there is always an air space providing for expansion of twelve to fifteen per cent. Explosion is prevented by a fusible alloy plug in the cap. Because of the length of the intake pipe, theft of gasoline is exceedingly difficult. The tank can be installed on any truck.



Pat # 2090197
American Safety Tank Co.
Kansas City, Mo.

Four-Crankshaft Air Engine Is Fast Without Vibration

Los Angeles, Calif.



Left, motor with propeller in place. Right, view of the propeller shaft being driven by the engine's four crankshafts

terbalancing weights are provided on the short crankshafts and in addition the inertia of each piston is counterbalanced by the opposite pistons, which are traveling in the same directions simultaneously. The reciprocating rod and gear masses serve as a fly-wheel to prevent push and pull strains on the gears. Test stand runs up to 5,200 revolutions per minute have been made without development of vibrating periods. The greater horsepower obtained at such high engine speeds can be reduced to lower propeller speeds by selection of the

Designed with four crankshafts instead of one, a new 180-horsepower radial aircraft engine is high speed without vibration. The crankshafts are spaced around a master propeller shaft and operate the propeller shaft by means of herringbone gears. Cylinders of the eight-cylinder engine are mounted in pairs, the four sets being at right angles to each other. Each piston in each pair drives one of the crankshafts through a separate connecting rod. The cylinders may be fired in various orders. Since the design virtually eliminates vibration, greater power output through increased engine speed is attained. Coun-

proper gear ratio between the crankshafts and the propeller shaft. One advantage of the straight, hollow tubular propeller shaft is that as many as three 500-horsepower units may be mounted on the same shaft without building up excessive stresses, providing 1,500 horsepower to the propeller and at the same time eliminating total failure of power in case any one unit goes out. The straight hollow propeller shaft permits gunfire through it without synchronization with the blades, and allows installation of a direct controllable pitch mechanism. The engine employs a simplified oiling system.

Homemade Bicycle Trailer Aids Newspaper Carriers

Unable to cover their fourteen-mile newspaper route by bicycle alone, due to the weight of the papers, two New Jersey boys constructed a bicycle trailer. They purchased two bicycle wheels on which the trailer body was mounted. The body has a capacity for a large number of newspapers. Construction of the trailer was accomplished with a combination jig saw, sander and lathe. The boys now cover the route in one-third the time required before they built the handy trailer.



Cont. Williams, Jr. Miller Caldwell
66. Gould Place

Oakeswell mfg. Co. 2427 E. 1st St. Los Angeles, Calif.
 Martin and Edwards 10010 Lois Place Richmond, Va.

Oil Pool Used in Movies for Reflection Shots



This scene from "Heidi" illustrates the use of oil pools for reflection shots. Note the clarity of the reflection. The camera crew is shown riding a boom over the pool

Found to have a better reflecting surface than water, crude oil is being used in pools for reflection shots in movie studios. Camera crews, riding a boom over an oil

pool built on the huge sound stages, get unusual reflection shots. The picture above, made during the filming of "Heidi" clearly outlines all reflections.

Fast Highway Striper Covers Twenty-Five Miles Daily

Laying down twenty to twenty-five miles of striping per day, a new mechanical marker for applying the white stripe to divide highway traffic lanes is in use in California. It supplants hand-propelled machines that covered a fraction of the distance in the same time. The striper applies either a four-inch white stripe or two three-inch stripes, divided by one of black. It is specially built, a four-wheel, motorless chassis, equipped with spray guns and a device extending well in front and connected with the steering gear to fix the position of the stripe. The machine is pushed ahead of a truck mounting the compressor and paint tanks.



This motorless striping machine covers many miles of road during the day

Built by Engineers, Division of
Highways, Dept. of Public Works.

cont. Tom White Box 44 Alameda Calif.

State of California, Calif.
Sacramento, Calif.



BRUTE FORCE *Loses out*

Thomas E. Symson, Jr.
10555 Holmwood Ln. Los Angeles
 By Charles Morrow Wilson



CABLE-DRIVEN hoist drums capable of a fifty-ton straight lift, tractors instead of horses, electrically operated log carriages, automatic log skidders, giant Diesel-driven logging trucks with power-operated hoists.

These are a few of the things which are changing the American lumberjack of old to a forest technician and which are helping to conserve American timber resources.

Paul Bunyan, legendary figure of the big woods, was pictured as a superman who singlehanded mowed down forests, scooped out lakes, dug river channels, and snapped off giant trees as if they were toothpicks.

Today a lone woodsman can literally fell a forest giant and drag it to market. But his power is not superhuman. It is the result of rapid and ingenious growth of mechanical equipment.

The tractor is actually the basis of the new age of American forestry known as "selective logging," upon which timber conservation now depends most heavily.

Top, great log being lifted onto flatcar. Bottom, sighting direction in which tree will fall

Calif. Cellular Co.
Pennington

H/82

Clymer - The Pas Lumber Co Ltd



The Pas, Manitoba, Canada

In the former steam and horse era of woods operation "universal logging" was standard practice. This meant destruction of all trees.

Besides wiping out millions of acres of the best forests, universal logging showed other serious faults. Its use of steam railways with wood-burning locomotives and its practice of quartering great numbers of workmen in woods caused forest-fire losses to increase from a few thousand

acres a year to a high of thirty-three million acres. Today modern fire-prevention methods, including fire lanes, towers and airplane patrol have succeeded in cutting losses from forest fires to about half.

This is one reason why we find that healthy, protected trees are growing more rapidly than timber is being used. Another reason is that truck and tractor logging, with modern mechanical accessories, has outdated the earlier practice of "clear

to ENGINEERING SKILL



Top, Diesel tractor hauling log train on icy road. Bottom, tractor pulling, or "skidding," logs through woods. This equipment handles giant logs with unusual ease

Redwood

Willamette single drum winch

Redwood Co.
 Clyde - 8 N. V. 200 ft
 % Lumber Co.
 Latta Drive

Westerly Diesel
R 12 8

Clamer Madigan Logging Co.
Ellenwood, Washington County
Oregon



cutting" or removal of all timbers.

With the efficient new equipment, logging operators can now afford to go into a given forest area and take out only the particular type of timber desired for a given market. The importance of this method is evident when one realizes that present industrial demand for timber has grown highly specialized. There are now 1,770 different kinds of trees in American woods and more than 100 varieties meet particular demands in timber industry. Our commercial uses for wood have increased from about 2,000 to more than 4,500 within the past ten years.

We still have almost half as much timber fit for sawing into lumber as when the first Pilgrim chopped his first tree in New England. The total U. S. forest acreage is still more than a fourth of the entire nation—actually more land for growing trees than for all crops, pastures and ranges combined. If gathered together our remaining forests would make a 225-mile-wide tree belt entirely across the continent.

Use of our forests represents a ten-billion-dollar investment of capital, jobs for more than a million men and women and a yearly money return half as great as total earnings from farms. This timber is our one basic resource ideally suited to conservation practice, since forests can be replaced as they are used. With the practice of selective logging there is every reason to believe

Top, tractor pushing logs into river. Center, spar pole on flatcar speeds up logging. Bottom, sixteen-wheel truck used for hauling logs to sawmill over board road

Calanbulay - Shesul 4-18
Re 202. Le Tourinore
Bullenger
Ref: James Stevens, West Coast of Seattle
Timbering in Area. Stear Oldy West



that American forests will be more productive a century from now than they are today.

The nation has individual mills capable of turning out a million board feet of lumber a day. Back of the 20,000 lumber mills now in operation in the United States are forests equipped with more than 30,000 miles of logging railroads, with thousands of tractors, chutes, flumes, dams, canals, tugboats, rafts, cableways, aerial trolleys and other log-moving equipment which requires about 200,000 workmen to operate.

The new story of American timber is becoming a story of transportation as well as conservation. Logging used to be almost entirely a local enterprise. Now the development of great timber areas and more specialized industrial demands for the different woods make transportation the number-one cost and problem in timbering. Seventy years ago timber sources were largely local. By 1914 the average haul necessary was 360 miles. In 1924 it was 725

miles. In 1938 it is about 1,100 miles. In the Northeastern states logs must travel an average distance of 840 miles; to the Lake states 910 miles; to Central states 1,515 miles. From the Pacific Northwest to the consuming markets of the east the average rail haul is 2,600 miles and the average water haul is 6,000. Eighty-eight per cent of the soft-wood timber used grows on the west side of the continent,

(Continued to page 124A)



Top, load of huge fir logs on flatcar ready for shipment. Bottom, tractor with equipment powerful enough to lift fifty-ton load of logs off ground

Colapiller, Forest R. of
and Willamette Rich.

Lamp Gives Polarized Light Free from Glare



Polaroid stops horizontal waves, lets vertical ones through. Only the useful or seeing light reaches the eye.

Top, ordinary light on magazine pages. Below, using polarized light. Note clarity

Providing illumination free from reflected glare, a new type of lighting unit was demonstrated recently. It was a desk lamp arranged so that light from an ordinary bulb was passed through a sheet of Polaroid, a transparent material, to remove the light waves that cause reflected glare. Those waves or vibrations of light useful for seeing were not affected, but

the waves ordinarily reflected as white specular light or glare were eliminated. The effect on the printed page was a startling clarity of detail unobscured by reflections. With glare eliminated, other lighting problems may be solved. Intensities can be increased to desired levels without the otherwise proportionate increase in reflected glare frowned upon by optical authorities. The light source may be placed directly in front of the reader, thus assuring even distribution of light across the page without concern as to reflections. While the reader has no sense of brightness with polarized illumination, much higher intensities can be maintained. Glare, according to optical experts, impairs the visual function because it bleaches out the visual purple faster than it can be regenerated by the human system.

Magnifier for Photo Enlarging Permits Sharp Focusing

Sharply focused enlargements result when the photographer uses a vest pocket ground-glass magnifier now available. It takes the guesswork out



of focusing on the enlarging table. Mounted on a metal base and angular support are a mirror, a ground glass and magnifying element. Light from the negative is transmitted through the enlarging lens to the mirror which reflects the magnified image through the glass screen.

Grass Seed Scattered by Planes after Fire Destroys Forest

Forest fire devastated a vast area of timberland in Coos County, Ore., in the fall of 1936, but today, thanks to the airplane, sheep and cattle graze on 12,000 acres of luxuriant grass where the forest stood. Grass seed must be planted quickly over a burned area, for delay would give fireweed a chance to get started. To save those acres from total loss, the county bought an airplane, equipped it with seed hoppers and sent it over the charred

all my in glasses

acres. It carried 1,200 pounds of grass seed each trip, seeding fifteen acres a minute, 150 acres each trip. The plane saved time, saved cost, for the seeding was figured at twenty-one cents an acre, and a healthy stand of grass was given a start promptly. Rice fields in California are being seeded by plane, too, and airplanes are being put to a variety of work over the western states—hunting coyotes, patrolling national forests, surveying for mountain highways, mapping timber and mineral areas, locating salmon schools for fishermen, dusting crops with insecticide, spreading smoke screens to protect citrus orchards from frost, and feeding wild life during the winter.

Children Study Bombing Plane from Cross-Section Drawing



Austrian child learns about bombing plane from drawing showing pilot, gunners and cameraman

Sectional charts showing the "works" of an air bomber are used in Austria to teach the construction and uses of this type of fighting machine. The diagram shows machine guns mounted in the nose, and both above and below at the rear of the cabin. The bomb racks are seen at the center.

Salesman Projects Rug Pattern on Floor of Tiny Room



Customer visualizes appearance of room as salesman operates projector throwing rug pattern on floor

To demonstrate patterns in linoleum floor coverings, a manufacturer has developed a special projector which throws the designs on the floor of a tiny three-walled room. The film is run through a projector housed in the top, and can show as many as 160 different patterns while the customer watches.

Waste Piped from Dairy Barn to Fertilize the Farm

To make use of the waste from his cattle barn as fertilizer, a Tennessee farmer collects the waste in a concrete reservoir ten feet by twenty, and five feet deep, then pumps it through 370 feet of two-inch pipe to a hilltop. From there the fertilizer flows on the ground or in wooden troughs to any part of the farm it is directed. The floors of the dairy barn are regularly flushed clean with water, and the waste drains into the reservoir. A heavy mesh screen at the pump prevents clogging.

Armstrong Carb Co
Cambridge

Cameron motor pump -
Ingersoll Rand Co
N.Y.C.

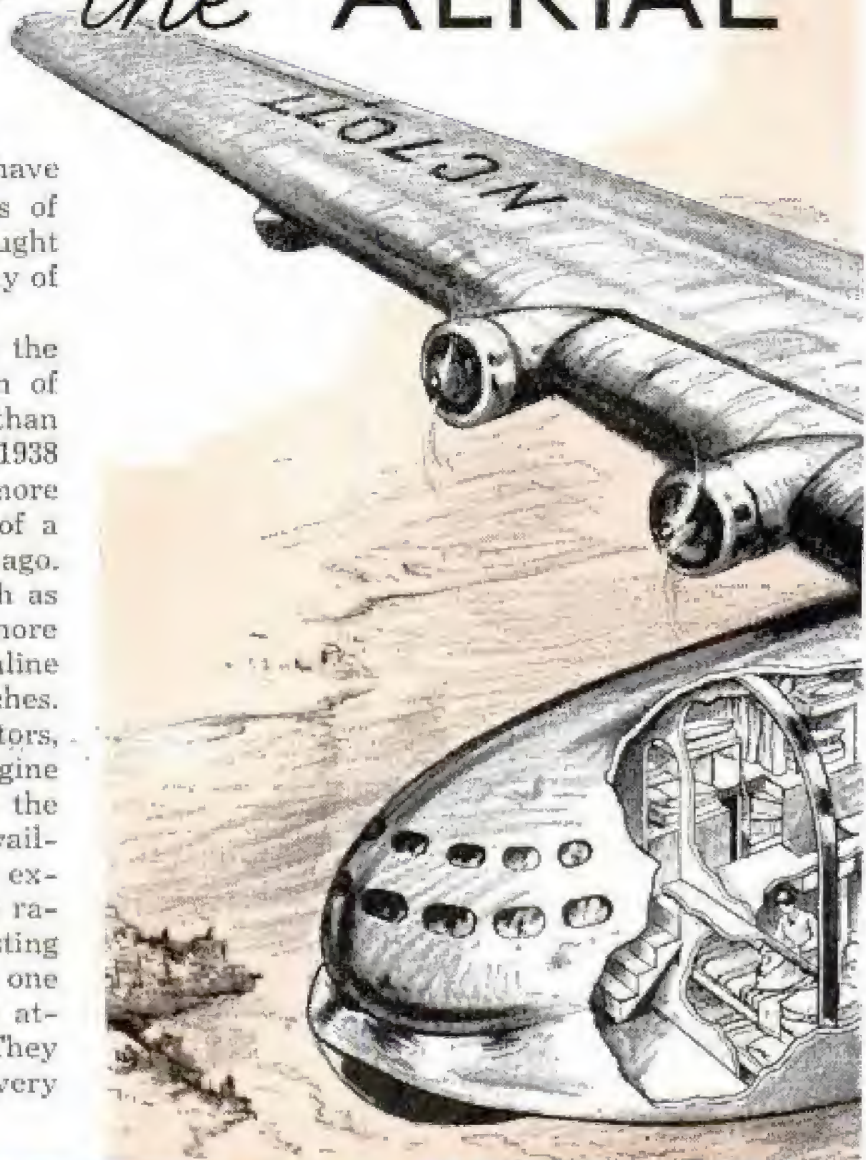
H 141 Cmr. J. M. Simpson Jr.
10555 Holman Ave
Los Angeles Calif.

AGE of the AERIAL

FOR years aviation engineers have been discussing giant airplanes of the future. This year they have caught up with their prophecies and the day of the aerial monsters is here.

One thing that has helped make the dream come true is the perfection of aviation engines far more powerful than any of the past. One engine of a 1938 four-motored airplane develops more power than the total horsepower of a tri-motored transport of ten years ago. Four such engines provide as much as 6,000 horsepower for take-offs, more power than is required by a streamline engine to pull twelve railroad coaches.

These tremendous air-cooled motors, the latest developments of the engine manufacturing companies, are on the "military secret" list and are not available to everyone, nor may they be exported abroad. They are twin-row radials of improved design, consisting essentially of two radial engines, one placed right behind the other, and attached to a common crankshaft. They develop one horsepower for every pound and a quarter of weight.



Bottom, view of workmen busy on giant fuselage and wings of Douglas transport, DC-4. The scaffolding forms a sort of dry dock in which the plane was assembled like a ship

MONSTERS



Drawing of interior of Consolidated's version of transoceanic air liner. Note the double-deck arrangement and luxurious accommodations, very similar to those of ocean liners

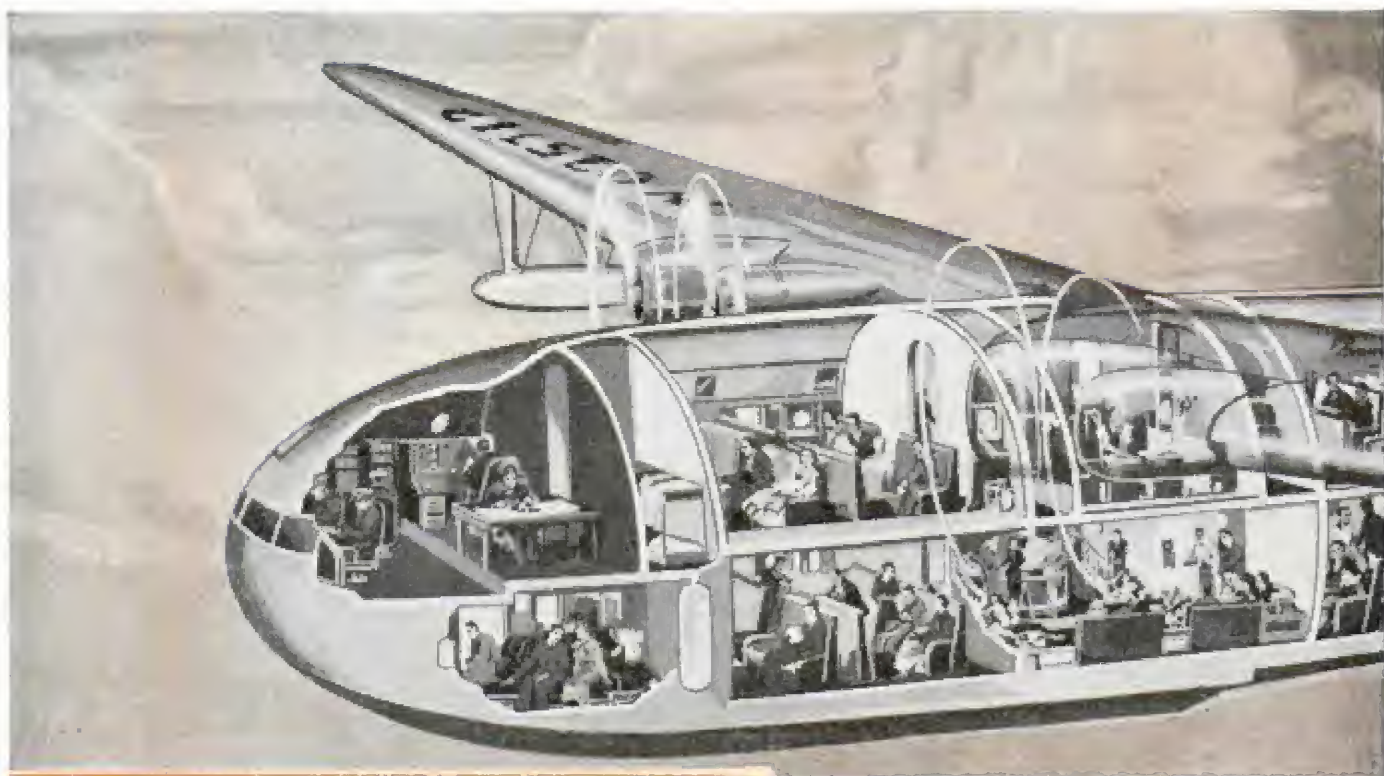
The new airplanes made possible by these engines actually dwarf the present giants of the airways. The new DC-4, to be launched soon by the Douglas Airplane company, was assembled like a ship, in a sort of dry dock.

The DC-4 has nearly three times the gross weight of the big Douglas transports now in service. The four-motored plane has a wing spread of 139 feet. Its fuselage is ninety-seven feet long and it stands twenty-four feet high. It will carry forty-two passengers and a crew of five, as well as three and a half tons of mail and express. The plane will have a top speed of around 237 miles per hour at 8,000 feet, a

cruising radius of 2,200 miles, and a service ceiling of around 23,000 feet. The plane weighs 65,000 pounds fully loaded and will be able to cross the continent with only one stop. Research, engineering, and construction costs on this first giant amount to one and a half million dollars. The plane was built at the joint order of the five leading domestic air lines. The idea of this united action is to develop a standard type of super-transport.

Instead of settling down on a tail wheel in landing, the DC-4 will land level with the ground with its tail remaining in the air. The plane uses a retractable tricycle type of landing gear that employs a nose

*A. M. Rochlen
Public Relations Sec.*



Top, nose of Martin's concept of transatlantic air liner. Bottom, mock-up of DC-4 passenger compartment

wheel instead of a tail wheel. The two huge main landing wheels are twenty-six feet apart.

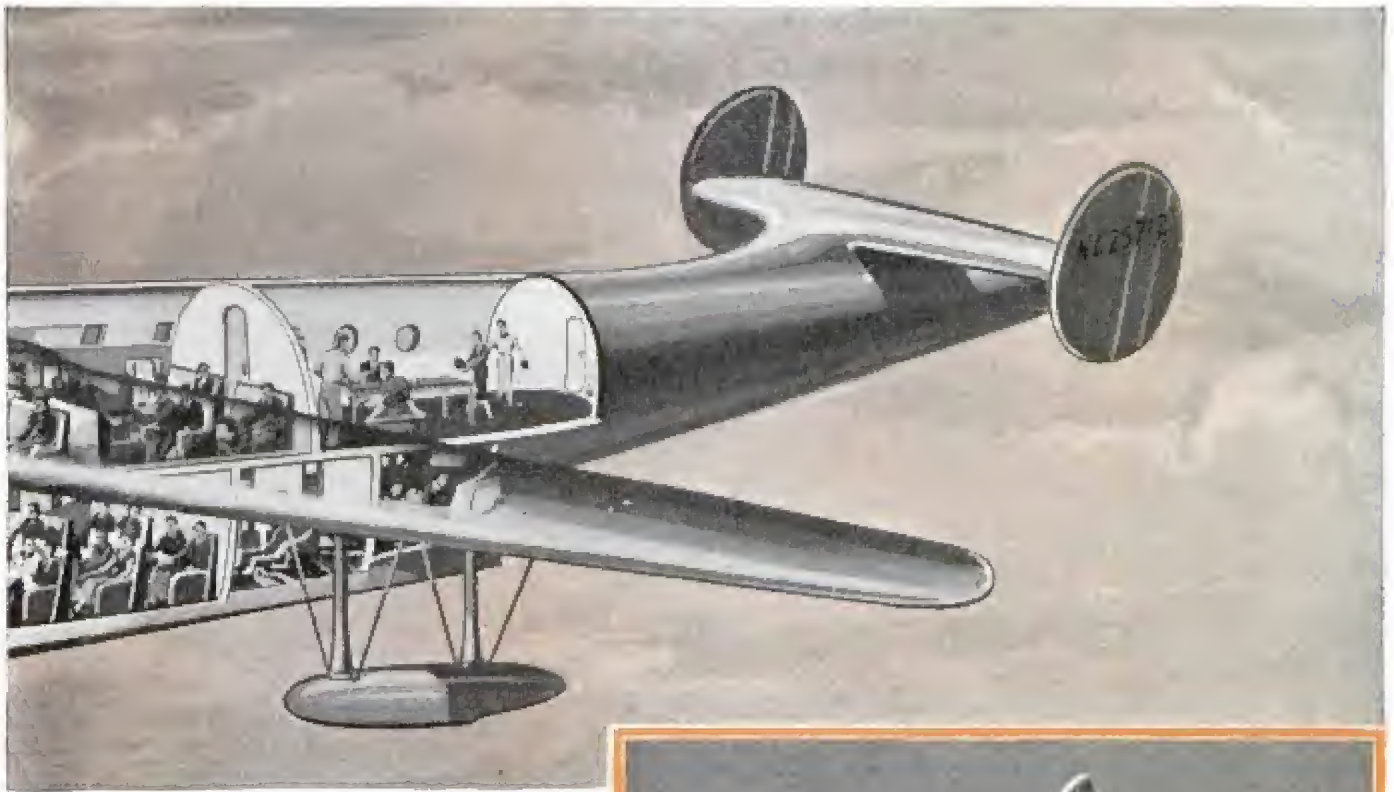
Instead of a conventional tail the plane has triple vertical tail surfaces. The new arrangement allows better control with half the power plants not operating. The horizontal airfoil surface of the tail group is about the size of the wing of a small bomber. Control surfaces are so large that manual control by the pilot is augmented by hydraulic booster pumps. Some of the control cables are nearly one-half inch in diameter. For the first time in a large airplane, flat flush-type rivets are used in fastening the outer metal skin, materially reducing resistance.

To make sure their calculations provide

the needed safety factors Douglas engineers performed more than 300 major physical tests and approximately 1,000 minor tests before construction really started. Hundreds of thousands of dollars were spent on building up vital parts of the plane and then testing them to destruction. The special anti-frost laminated glass for the cockpit windows was subjected to temperatures of forty degrees below zero to make certain that it remain transparent under extreme conditions.

Approximately 20,000 pieces of metal, fittings, and sheets, exclusive of rivets, were used to build the plane and inspectors stationed in the dry dock approved every part before it could be added to the structure.

The lighting and other secondary power requirements are so heavy that auxiliary engines instead of batteries are used for the circuits. These air-cooled auxiliary engines drive alternators furnishing enough 800-cycle 110-volt current to light a huge office building. They also operate vacuum pumps for instrument-operating vacuum, provide pressure for the de-icers, run a hydraulic pump for the autopilot, and furnish pressure for the main hydraulic system that operates the air flaps, landing gear, and the minor hydraulic units. The



exhaust systems of these engines pass into the exhaust pipes of the propelling engines, being located so as to pass through steam boilers for cabin heating, making heat for the boilers available even when the plane is standing on the ground with the main propelling engines not operating.

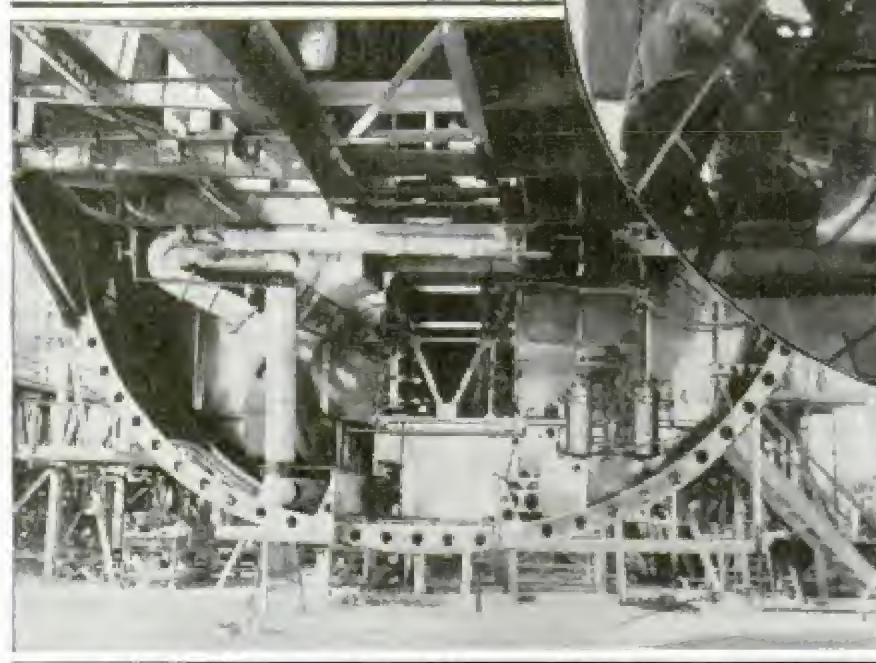
Inside the huge cabin various arrangements of comfortable lounge chairs, reclining chairs, or sleeping berths are to be installed according to the desires of the different air lines. The different plans all include dressing rooms and a large galley under the care of a steward and stewardess. There are thirty-two windows in the



Top, interior of Martin plane shows passengers at play. Center, model of the DC-4. Bottom, interior arrangement of DC-4, showing deep, comfortable berths for traveling at night

main cabin space, sixteen upper skylights, and two portholes. Space beneath the cabin floor is used for baggage and express, providing more room than is available in many large sized trucks. Provisions are to be made for installing air-compressing gear and for sealing the cabin and cockpit for substratosphere flying.

In the cockpit the pilot and copilot sit farther apart than in present transports, the space between them being taken up by a wide control stand upon which



At the left is a view of the "basement" of a super-airliner. Here, under the floor, may be seen in process of completion the maze of controls, heating, electric and ventilating systems. Above is the rudder

are mounted all engine operating levers. Throttles are duplicated on each side of this pedestal so that it is not necessary for either man to reach across it. A third seat behind the pilots is provided for a flight engineer, who also has access to all engine controls and who thus can relieve the flying crew of all engine operating problems.

Four single engine fuel systems are provided, each engine having its own 100-gallon tank of high octane take-off fuel and its own 300-gallon tank of cruising fuel. One main selector switch on the engine pedestal changes over all the tanks in one motion. In addition, supplemental bypass levers make it possible to route fuel from any of the tanks to any of the engines. Engine-driven fuel pumps are supplemented by hand pumps in the cockpit. To make certain that this large fuel-delivery

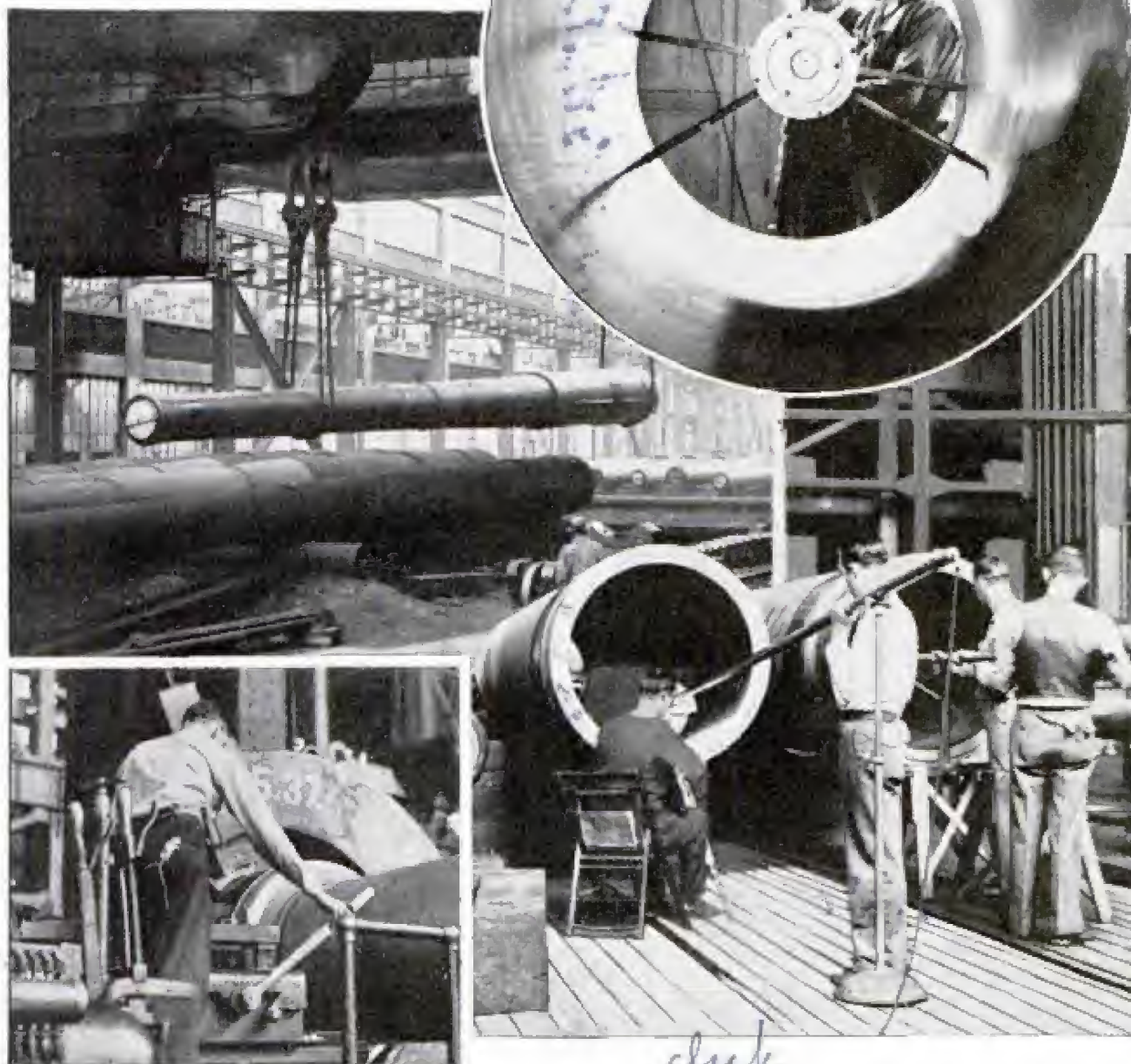
system is foolproof in every respect, the engineers conducted comprehensive tests with a full-scale mock-up. They even had to make allowances for such conditions as the rearward acceleration of fluid in the fore and aft fuel lines during take-off, which in some systems results in a temporary drop in fuel pressure at the carburetors.

One problem magnified by the size of the plane had to do with the engine control system arrangement. Each of the outboard engines is seventy feet away from the cockpit, yet it must respond to control adjustments as rapidly and easily as if it were only a few feet away. A combination of push-pull rods at each end, connected by cables stretching through the wing, was found to be the answer. In cases where

(Continued to page 127A)

Making Navy's Big Guns Calls for Precision

Circle, right, taking inside measurements of sixteen-inch gun with star gauge. Left, parking navy rifle after its completion in Washington navy yard. Bottom, left, machining outside of gun. Right, checking bore and inside measurements of a gun



club.

Building big guns for the United States navy is a job calling for extreme precision, because one little flaw in a gun barrel might easily cost the lives of the gun crew on the first occasion the weapon was fired. When the casting of a big gun is sufficiently cool, it is taken from the mold and placed in the hands of machinists. The barrel goes into a giant lathe and the machinists, all experts at their job, turn the

inside and outside diameters. As the work progresses, measurements are taken on the inside with a star gauge. The finest precision is necessary at this point, for on it depends the accuracy of the gun. In addition, experts examine the bore for material defects. When the gun is completed, a big traveling crane picks it up and transports it to the gun park where the naval rifles are stored.

Big Shoe Built on Car Body Latest in Advertising



View of giant shoe constructed on the body of auto.
The shoe weighs 1,000 pounds

Designed as a means of advertising, a giant shoe built on an automobile body tours the country. It is size EEEEEEEEE-EEEE, and is fifteen feet four inches long, five feet four inches wide, five feet high. It weighs 1,000 pounds. Built into the shoe is a loudspeaker which is used for advertising purposes.

"Fountain Pen" Pressure Oiler Ejects a Tiny Drop of Oil

"Nosing" into out-of-the-way places that are hard for the ordinary oilcan to reach, a "fountain pen" oiler ejects a tiny



When steel point of "fountain pen" oil can is pressed, a drop of oil is ejected just where it is wanted

drop when its steel point is pressed. No oil is wasted, no part is drenched with oil, for the amount ejected at each application is about one-tenth of an average drop. It is designed for oiling office machines, clocks, guns and fishing reels, electric appliances and similar machinery.

Fast-Drying Cement for Walls Sets within Two Hours

Unusual strength is claimed for a new type of fast-drying gypsum cement just developed. Highly resistant to weather, acid and mechanical wear, it sustained 600 to 1,200 pounds tension per square inch in tests, and ten times that strength in compression. Used for plastering walls and ceilings, this hydraulic cement can be controlled so that the first coat sets within one to two hours, making it possible to apply two or three coats in a day.

Metal Stand on Ironing Board Saves Lifting of Iron

Considerable effort in lifting a heavy iron repeatedly can be saved by using a metal rest which is fastened to the ironing



Asbestos lined, the metal pan provides resting place for iron which slides on without being lifted

board, its edge flush to the board so that the iron slides on it easily. The rest, just put on the market, is lined with asbestos to prevent scorching the board cover.

Four parts of molasses, two of slaked lime, and one of charcoal powder is the recipe for a road surface that sets in four hours, is ready for traffic in twenty-four

Compressed Air May

made by mechanics of
Donald Bellin, Inc.
Bufford, La. a.

#142

Pres. 38

Patd by J. D. Spayd & Co. 7th Chicago

The Bell Hfg Co
687 E. 82nd Cleveland

July 1938

Since America's pastime provides an income for more people than does the real diamond industry that puts jewels on milady's fingers, manufacturing baseballs and bats for the game is big business.



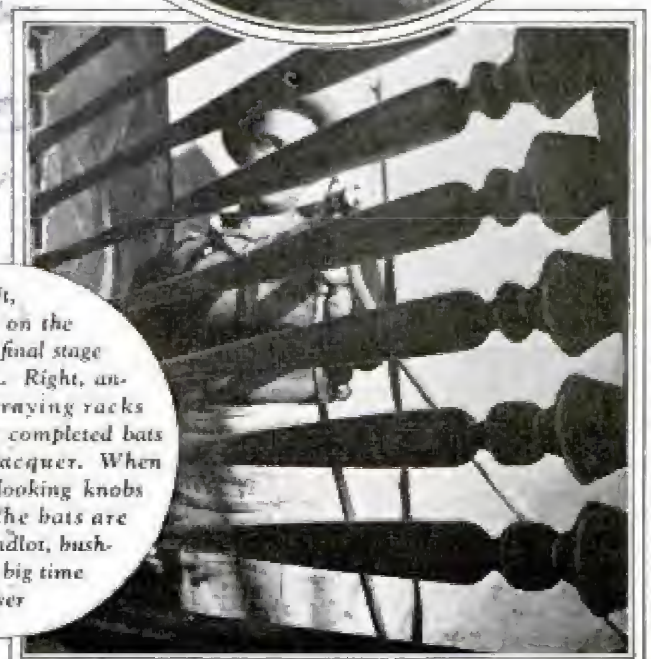
Top, left, cork and rubber core of baseball as first yarn is wound upon it. Right, machine winding yarn on two cores at the same time. Three layers of yarn are put on each core before horsehide cover goes on



Center, left, after third layer of yarn is wound on the bull, it is weighed to conform to big league specifications. Right, horsehide covers cut in the peculiar shape to get a perfect fit



Left, stitching on the covers, the final stage in production. Right, angle view of spraying racks where the almost completed bats are coated with lacquer. When the peculiar looking knobs are cut off, the bats are ready for sandlot, bush-league or big time player.



Compass on Handlebar Post Adds Fun to Bike Riding

\$1.60



Compass, shown in circle, is mounted in streamline housing on post attached to bicycle handlebars

Watching a compass brings extra fun on a bicycle ride. A compass designed especially for bikes is being offered, housed in a streamline mounting at the top of a post that clamps over the handlebar.

Film Speed Increased by Bath in Mercury Vapor Kit

Photographic film speed can be stepped up by a "mercury bath" kit now available for the amateur cameraman. The fact that

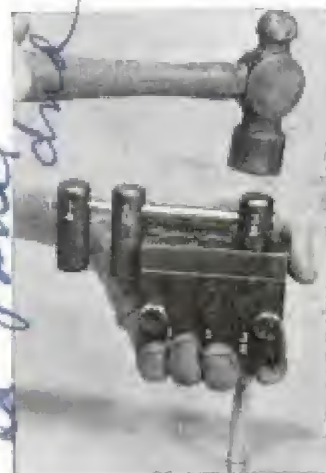


mercury vapor increases the sensitivity of film has long been known. This hypersensitizing kit consists of a lightproof, airtight container in which miniature films or short reels of amateur movie film can be stored for two or three days with a small glass capsule containing liquid mercury, increasing the speed of the film by seventy-five to 150 per cent. Even if left in the original package, film is speeded up by the

same percentage when exposed to the mercury twice as long. Film hypersensitized before and after use in the camera showed increases from 125 to 150 per cent. When the mercury discolours from oxidation a new capsule can be inserted.

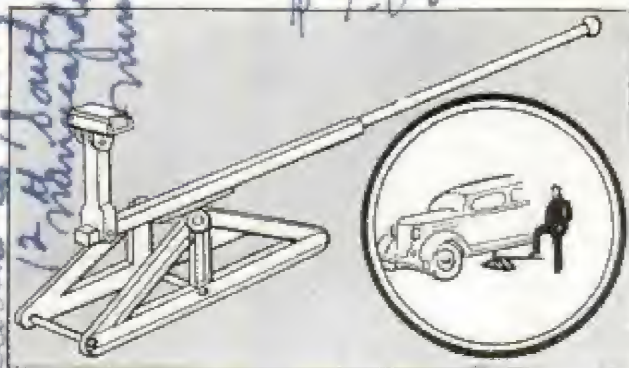
Tool Beads Tubing to Provide a Tighter Connection

To provide tighter connection of tubing, a new tool swedges a bead on the tubing. The bead prevents the tubing from pulling out at its connection. The device accommodates one-quarter, five-sixteenths and three-eighths inch tubing.



"Wigglebug" Rocks Car to Save Time in Lubrication

Time may be saved in lubricating the automobile if a new "wigglebug" is used for rocking and shaking the car to get grease into frozen or dry bearings and springs. The device makes contact with



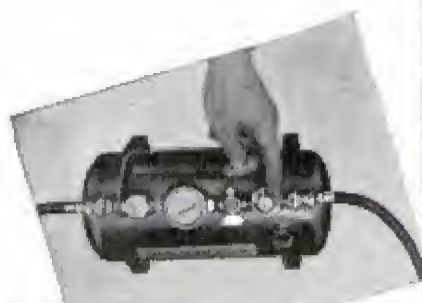
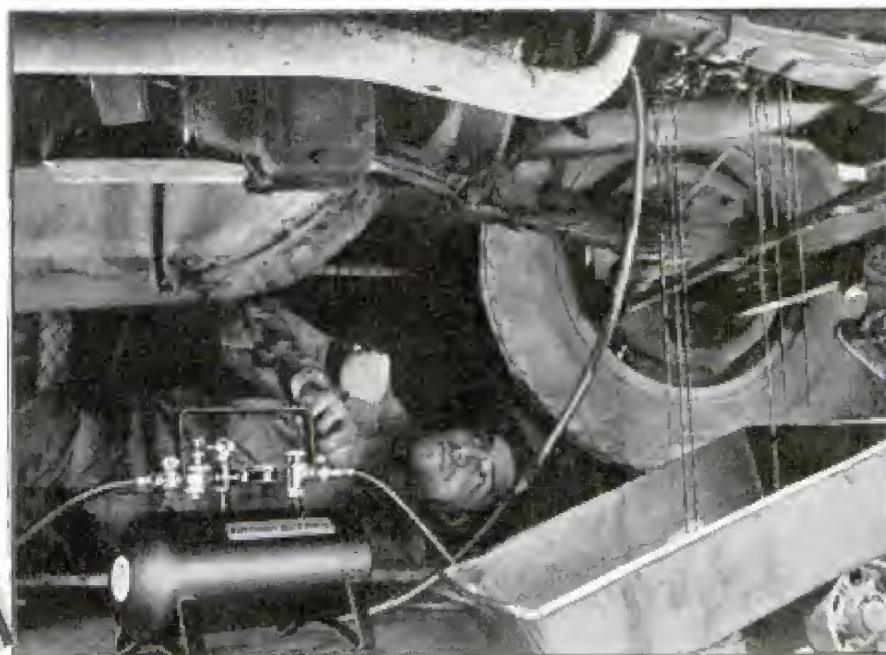
Here's the "wigglebug." Circle, how it is used to rock the car

the brace under running boards or with the bumper. A three-inch adjustment in the contact post permits use of the device on any car manufactured.

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

Oil Leak Detector Shows Bearings' Condition

Above, two views of oil leak detector. Upper right, detector in use, analyzing oil being taken from the motor to show condition of bearings



Bearings may be tested quickly for wear without tearing down the engine by using a new oil leak detector. Compact, lightweight and portable, it works with scientific accuracy and uniformity in tests of full-pressure lubrication systems. The detector consists of a small tank, equipped with the necessary gauges, and a convenient oil filter top, with two hose connec-

tions, one to the air line and the other to the engine. After the oil pan is dropped, the detector is hooked up and with controlled air pressure, oil of the correct viscosity is passed into the engine under maintained and accurate air pressure to all bearings and oil lines. The tank is fitted with a pressure control valve which maintains twenty-five pound air pressure, regardless of air pressure at the air line. It also has suitable means for keeping oil and air separate, so that oil viscosity is correct and the oil does not become a foam. A screen assures passage of only clean oil into the engine. Used in the automobile owner's presence, the device will show whether new bearings are needed and whether all oil lines and headers into the engine are functioning properly.

Humane Muzzle for Dog Permits Animal to Eat and Drink

While a new type of muzzle makes the most vicious dog harmless, it does not prevent him from eating ordinary food nor drinking. Known as the humane muzzle, it is made of a rustproof plastic material and consists of a ring that fits over the dog's nose and a small rod that goes through the mouth, back of the eye teeth. The ring prevents the dog from opening his mouth far enough to let the rod slip out. The muzzle is fastened with a small, lightweight padlock.



Two views of the humane muzzle. Left, as muzzle appears before being locked on dog

Federal - May 1931 - 11031 - possibly copy of original - much
J. B. White, Editor, National Sportsman, N.Y.
J. B. White, Editor, National Sportsman, N.Y.

es 1356 Cont. John P. Blackburn
 1224 d sabella H
 W. Almette Ill

ELECTRIC PLANTS Offer



Electricity from a power company than to make it yourself, it is no longer necessary to wait for the coming of the high lines to get it. About 800,000 rural homes today enjoy some sort of homemade current produced by plants ranging all the way from little wind chargers selling for less than \$50 up to big 5,000-watt systems which supply all the current needed for a home and make enough extra to light the barn and other outbuildings and run a lot of stationary farm machinery besides.

If you can't hook up to a high line, there is just one way to get electric light and power. That is to make it yourself. In making your own juice, you have a choice of

ABOUT one-third of America's 31,000,000 homes still are unconnected to electric power lines. Of almost 10,000,000 homes without central station service, about half are on farms.

Thousands of these rural homes will never enjoy the blessings of electricity if they wait for the high lines to bring it because they are in areas so sparsely populated that power lines cannot be made to pay for themselves. Even where the high lines reach out into the country, the outlook for wholesale rural electrification has not been encouraging. During the three years ending with 1936, it is estimated that less than 400,000 farm homes were hitched to the electric lines, bringing the total to 1,128,000.

While it usually costs less to buy elec-



Wind charger, top, which runs radio and two lights. Below, small gasoline-engine generator

Pioneer Gen. Co.
 Motor Corp.

Wind Charger Corp. 2700 Hanky
 1224 d sabella H
 W. Almette Ill
 1224 d sabella H
 W. Almette Ill

Wind Power Corp
newton, Iowa.

es 1356

POWER to EVERYONE

three systems. You can use a wind charger and let the wind do it for you, you can run a generator with an engine which uses gasoline or kerosene as fuel, or you can employ a small Diesel plant for the same purpose.

Like everything else, the amount of power you get depends to a great extent on how much you spend for a power plant. The larger the plant, the greater its capacity. An Oklahoma farmer, for example, enjoys a few of the advantages of electricity with the aid of a wind charger costing less than \$50. The outfit is intended to keep his radio batteries charged, but he has enough extra juice to run two lights, one in the kitchen and one in the living room.

The great advantage of the wind charger is that it offers current at low operating cost, since the wind is free. The disadvantage of a



POWER AVAILABLE ON FARMS IN 1930



EACH SYMBOL REPRESENTS 2,000,000 H.P.

Electricity can milk, hoist hay, pump water, do the washing, supply light and ice and do scores of other farm tasks if it were generally available

wind-driven outfit, of course, is that the amount of power is dependent on the amount of wind. In sections of the country where the wind averages ten miles an hour or more, air-driven electric plants usually are quite satisfactory.

For less than \$100, a six-volt wind charger, a battery and the necessary materials for wiring can be obtained. Such an outfit should run a radio and a few small lights and perhaps turn an electric fan of the automobile type. For a little extra, it can operate an intercommunicating system between house and barn and a loudspeaker in the latter building.

A thirty-two-volt air-driven electric plant, including generator, batteries and

Wenger & Stratton Co, 2711 N. 1st St, Milwaukee, Wis.



wiring, may cost several times as much, but it will supply an average home with all the current needed except for cooking or water heating. Such a plant not only takes care of the lighting and runs the electric household appliances on one Illinois farm, but also supplies power to run a washer, a refrigerator, an iron, a churn, an emery wheel, a forge blower, a soldering iron, a band saw, a rip saw, a planing mill, an air compressor, a rotary pump and a car battery charger.

For those who want to be independent of the wind and who desire a plant which may be operated continuously at or near its full capacity, a generator driven by an engine burning gasoline, kerosene or perhaps fuel oil meets all requirements. Engines are now produced which will run 4,000 or 5,000 hours without much attention, and the cost of operating some of them is estimated at less than five cents per kilowatt-hour. With the muffler buried in a barrel of stones or otherwise sound-insulated, the engine makes little noise.



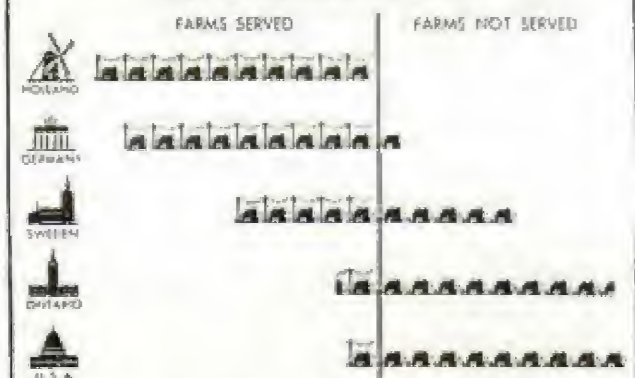
Such a charger developing up to 100 watts at six volts may cost about \$35 and will run eight or ten lights and charge the radio batteries. For around \$60 a charger which develops 200 watts at six volts can be obtained. This outfit will take care of the radio and run the lights in a small home. A six-volt charger also is combined with a gasoline-powered washing machine, permitting battery charging while the family washing is being done. The system also can be run continuously, if desired.

A 400-watt system supplies all the lights needed for a small home and will also take care of the ordinary household appliances which are operated intermittently. For a medium size home, an 800-watt plant will furnish light and power for most ordinary purposes. For larger places, a 1,500-watt plant or even a 3,000-watt one may be needed to electrify the home and also provide enough power for pumping water, running a heating plant and perhaps operating some stationary farm machinery.

By using a 110-volt system ranging from

(Continued to page 136A)

RURAL ELECTRIFICATION



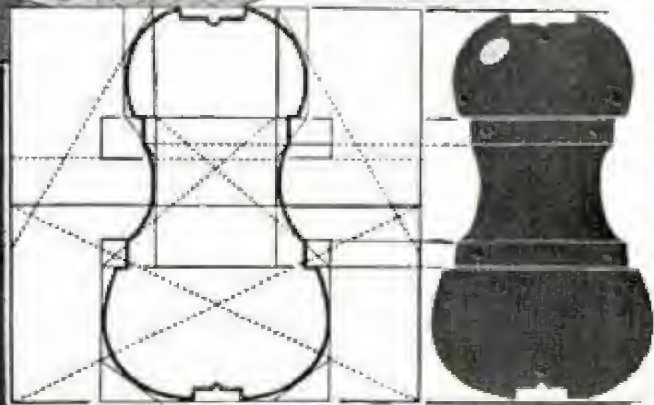
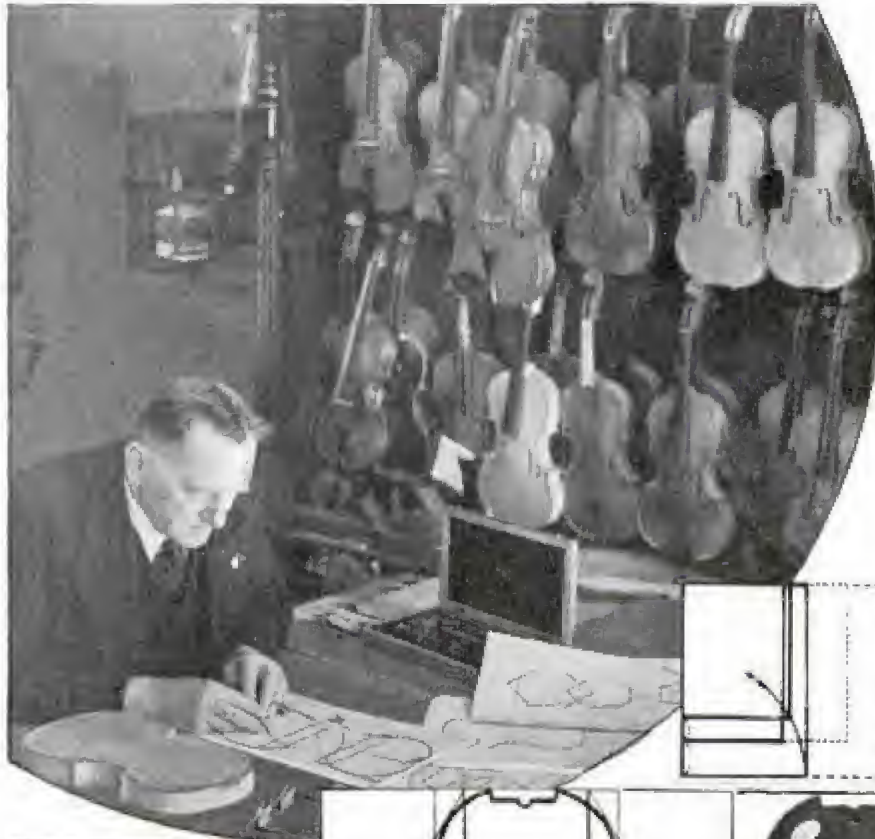
Wind charger, top, which runs radio and small lights. Center, battery and engine belted to motor generator. Bottom, rural electrification is much further advanced in some foreign countries than in the United States

Science Probes Secrets of Stradivarius Violin

For two hundred years violin makers have tried to match the beauty of tone and form wrought by Antonio Stradivari, the Italian craftsman, in his violins. Chemists have tested the old violins to learn whether the wood had been subjected to some treatment, and have even analyzed the veneer, without uncovering any secrets.

But today the violin makers by applying mathematics and precision measurements to the task are producing instruments that really rival the famed Stradivarius. The violin is first laid out on the drawing board, following mathematical calculations carefully derived from the original. These calculations take in not only the contours

but the thickness of the wood; delicate instruments are used to record the strength and measure the curves of both top and bottom, precise to a fraction of a millimeter. It is believed now that the success of the ancient craftsmen depended on their exact calculations before actual manufacture of the instrument, and this is the method followed by the master violin makers of today. The result of this process is the production of instruments so beautiful in form and tone that some critics cannot distinguish the new violins from those made by the old master.



Violins rivaling the famed Stradivarius instruments are made today by laying plans on drawing board, above, with mathematical precision. Below, delicate instruments measure thickness and contours of wood

no further information

Camera Helps Builder Project Future Road



One of the problems of the highway builder, that of fitting the road into its environment, is being solved with the aid of the camera. Photographs are made of the route of the projected street or road, the planner sketches on the photograph his idea of the completed highway, in perspective, and then the plan can be visualized and criticized before construction begins. For example, one project called for a highway cutting through woods and across valleys. Panoramic photographs were made, enlarged and fitted together; bridges were painted over the photograph and the composite picture itself was photographed. The result was a picture deceptively like the finished work.



Above is the photographic "eye" with which the highway engineer sees his project. Photographing the locale of road or bridge in panorama, he lays out his perspective drawing, shown at right, then photographs the finished picture

War Tanks Found Ineffective Against Trained Troops

In the opinion of Lieut. Col. Emilio Canevari, Italian writer on military subjects, in the journal, "Army Ordnance," war tanks are ineffective against trained troops. Tanks scored their success against the Germans in the world war, the writer holds, because German manpower had been depleted badly and what was left was of inferior quality and shaken in morale. But in the Spanish civil war, the tanks have been getting the worst of the argument since the government militia learned the business of fighting. Light tanks, that can make speed and get into places, are mere traveling tinpots, easily

subject to fatal puncture by heavy machine guns firing armor-piercing ammunition, according to the writer. Heavy tanks have to keep moving, for as soon as a tank stops, field guns find it promptly and end its career. Even while the big tanks are under way, they can be put out of action by thirty-seven millimeter guns and even by new anti-tank guns of about half that caliber. Furthermore, a moving heavy tank is of little effectiveness, except as a flame thrower, because it shakes and lurches so much that its machine guns and light cannon lose most of their ammunition in either air or earth. Infantry have

learned that at close range a heavy tank need not be feared, the writer points out, and in Spain the government troops have found they can ruin them either by exploding grenades in their tractor treads, or by pouring gasoline on them and igniting it.

Landing Lights in Cockpit Guide Pilot through Fog

Three bright dots shining in the cockpit of the plane are the fog-piercing "eyes" of a blind landing system now being developed. It makes use of ultra-short radio waves, a cathode-ray tube and the plane's "artificial horizon" to reproduce before the pilot's eyes the equivalent of landing lights on the hidden airport. Inside the cathode-ray tube, three electron "guns" shoot electrons and produce three light spots on the tube's fluorescent screen. When the dots are lined up horizontally, the pilot knows he is on the right glide path to the field. If he is off course, the dots move in the direction the plane has veered, up, down, to right or left. Four antennas fed by one radio transmitter send out the signals which, in conjunction with the artificial horizon, aim the electron guns and thus show the pilot his position with relation to the proper landing course.

Firemen Enter Blazing Ship in Asbestos Suits and Masks



Carrying their own oxygen supply and protected from fire, these men are equipped to attack flames in heart of blazing liner

Ready for the peril of fire at sea, the fire fighters aboard a North German Lloyd liner are provided with overall asbestos suits and helmets. They also carry electrical equipment, and wear oxygen masks to aid them in penetrating the smoke-filled interior of the ship in case fire breaks out.

Mule Put to Bed in 'Hospital' to Let Broken Leg Mend



Injured baby mule rests on bed in farm "hospital" while its broken leg mends

There is a three-bed "hospital" for mules on the farm of a stock raiser near Harrington, Wash. Until the hospital was installed the farmer lost several baby mules each year due to broken legs and other injuries when trampled. Now, after a veterinary sets the broken limb, the disabled baby mule is allowed to rest on one of the three old beds set aside for the hospital.

Freight trains in the United States traveled an average of 386.4 miles a day in the first half of 1937, a new record.

Railway Age
March 19 38

Vacuum Hose Sucks Waste into Refuse Truck



Driver dips lightweight hose into refuse can and vacuum sucks garbage into airtight container on truck

Clean, fast collection of garbage and refuse is provided by a vacuum truck that sucks the waste materials through a flexible, wire-reinforced rubber hose into a pressure-tight compartment. The tremendous volume of air created by the centrifugal exhaust aerates the garbage can and leaves it clean.

Plane Burning Liquid Hydrogen Could Circle Earth Non-Stop

When some inventor develops a safe, economical method of producing and handling liquid hydrogen, he will probably revolutionize air transport. Igor Sikorsky, aircraft engineer, says that an airplane using liquid hydrogen could circumnavigate the earth along the equator in a non-stop flight without refueling. Barring such revolutionary developments as that, however, Mr. Sikorsky believes the aircraft of the future will find a practical limit of 500 to 600 miles per hour and a top altitude of 75,000 to 90,000 feet. Air speed records have advanced from forty-seven miles an hour in 1909 to 162 in 1919, 357 in 1929 and 440.62 in 1938, and predictions of 1,000-mile speeds in the next generation have been made. Mr. Sikorsky, however, doubts that this speed will be reached. Experiments

show a change in the streamline flow around a wing and considerable increase in resistance to the moving body when it approaches the velocity of sound, about 760 miles per hour, and propeller efficiency diminishes above 500 miles per hour. The very near future, Mr. Sikorsky feels, will see a practical test of high-altitude air-line operation, with passengers riding above the weather in supercharged cabins at 300 miles an hour or faster. But he points out that a plane capable of flying at fifty miles an hour at sea level would have to fly 500 miles an hour at 100,000 feet altitude to stay aloft because of the difference in air density. Such a speed is too high for efficient operation of wings and propeller. Flight above 75,000 feet and 500 miles an hour therefore awaits development of a new method of propulsion and a new source of energy with more power per weight. Mr. Sikorsky predicts for the immediate future 100-ton flying boats crossing the Atlantic in twenty hours, and anticipates that these ships will be too vast for manual control by the pilot and must have mechanically operated controls.

Special Soap in Motor Sprayer Cleans Off Dirt and Oil

Dirty motor or chassis can be cleaned easily with a hand-pump sprayer now on the market. A special soap, soluble in water or kerosene, is used in the sprayer to take the "cling" out of oil, grease and dirt. The solution, with the accumulated dirt, is removed by water pressure.



Spraying soap solution on automobile motor to remove dirt and grease

Magnus Chemical Co., 22 South Ave.

14 302

Midget Radio Planes Test Gunners' Accuracy



Midget planes controlled by radio are being used in army target practice. Movie cameras mounted on guns automatically register hits and misses as dummy shells pour through the anti-aircraft weapons



Below, gun crew ready to "fire" at radio plane. Heretofore, targets were towed by full-size planes at several hundred dollars per hour. Inset, camouflaged gun

Top, left, photo showing a direct "hit." The film is thirty-five millimeter. Anything in the circle is a direct hit. Right, explaining how the plane is controlled by ground transmitter. Center, left, range finder with which the midget plane is sighted and its range established for the gunners. Center, right, ground transmitter and controls for manipulating the plane in the air. The little ships, built by Reginald Denny and Paul Whittier, have a top speed of seventy miles per hour and a ceiling of 9,000 feet



5751 Hollywood Blvd. Los Angeles, Calif.
 (Will not give)

The PHANTOM FLEET



production. To keep ahead of the times, such a laboratory must be rebuilt and completely changed almost from day to day in order to offer new or more severe forms of torture for car parts.

Nothing is too small, nothing too large for the mechanical laboratory to tackle. The one at the Chrysler Engineering building, for example, is

By H. W. Magee

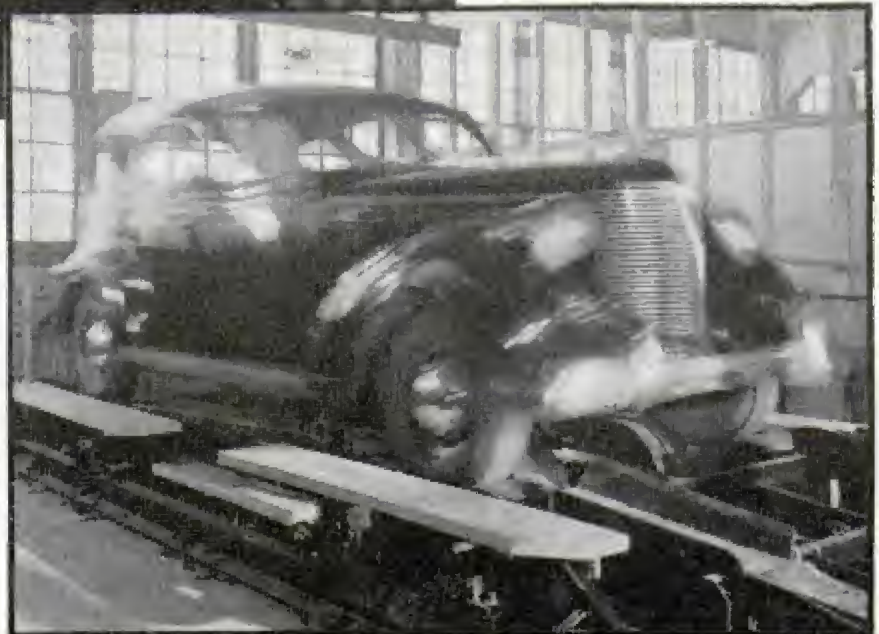
PART II

BEHIND all the road testing of new parts and new cars is the greatest automobile "proving ground" of all—the laboratory.

Without it, frequent changes and improvements in design would be all but impossible because an accelerated laboratory test quickly reveals facts which could be obtained only after months of road testing. In addition, many tests which can be conducted quickly in a laboratory could not be performed at all on the road.

Every new automotive development must survive a laboratory beating, but new devices are not the only graduates of this proving ground. Through this chamber of horrors for cars eventually pass most of the 35,000 individual pieces which go into some modern cars.

The many kinds of steel and other materials are checked here, and there are also constant breakdown and endurance tests for experimental parts and for parts in



Chrysler car dancing on the Belgian roll. Above, are lights which approximate bright sunlight test fading qualities of upholstery

equipped to test the performance of anything from a carburetor to a complete car. A walk through this laboratory shows every part of an automobile undergoing some form of punishment.

Perhaps the most spectacular test apparatus is the Belgian roll, a shimmy machine which shakes a car like a terrier might shake a rat. It consists of motor-driven rollers which impart a jolting impact to the car resting on them and was developed years ago to test cars which seemed to fall apart when pounded over the stone blocks of Belgium's roads. When running at full speed, the rollers shake the car until it dances and, in a few hours,

H/115

of the HIGHWAY



give it more jolting, bumping, bouncing and vibration than it would receive in thousands of miles of driving over the roughest roads.

Bolts, nuts, screws, license plate holders, bumpers and even doors used to rain from cars like hail after they had been in the grip of the roll for a short time. But cars are built better today. A modern automobile will waltz and shimmy for hours and, after tightening, be ready for more torture.

The engines on the test blocks receive the same punishment which complete cars get on the Belgian roll. In the bedlam of the motor test room, engines are running at full throttle, their exhaust manifolds glowing red. In twenty hours on the block an engine is given the equivalent of 1,800 miles of travel at ninety miles an hour—without a stop. That's like running three or four Indianapolis races.

Here modern aids of science help expose



Photos courtesy Chrysler Corporation

Test driver, above, giving some experimental parts a workout. Below, test driver reading thermometer which gives temperature of air outside the car.

the innermost secrets of cars and parts. Cathode-ray tubes, similar to those used in television receivers, magnify vibration in crankshafts, drive shafts and transmission parts 10,000 times, enabling engineers to see and study the vibration and eliminate the causes of the trouble.

841 Massachusetts Ave Detroit Mich



Machine which tests durability of gasoline lines, above. Right, miniature sandstorm, above, which tests efficiency of tie rod seal, below

And the same spectrograph which enables astronomers to probe millions of miles into the sky and tell what stars are made of also tells engineers in the laboratory what metals are made of. The spectrum of a piston heated to incandescence reveals the elements which compose the metal. There's no guesswork any more about metal structure in your automobile.

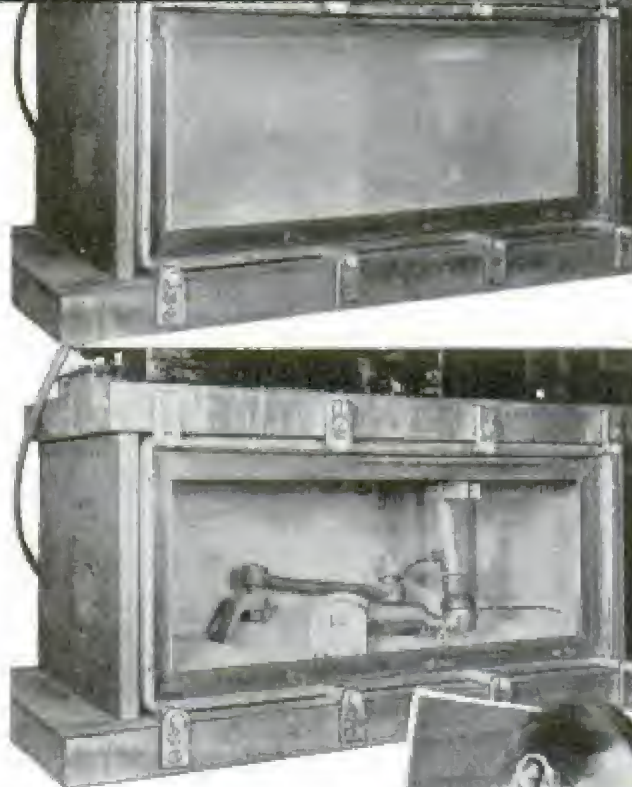
In an oversize refrigerator big enough to accommodate an automobile a test crew is "doing a stretch in Siberia." Dressed in fur-lined suits, these men are checking the starting characteristics of motors in cold weather. The thermometer registers forty degrees below zero but the engines seem to be standing the Arctic weather better than the testers.

On a full size dynamometer other engineers are giving a full size car the third degree, forcing it to disclose the exact number of "horses" hidden under its glistering hood. Near by is a carburetor test

stand where these units are being checked to determine the most efficient type and the most economical fuel mixture. Here the volume, motion, temperature and humidity of the air are under perfect control, something impossible in a road test.

Like physicians conducting a metabolism test on a patient, two engineers are making each cylinder of an engine "exhale" through an exhaust analyzer which is so sensitive that it detects one part of unused fuel in a million parts of waste gas—another experiment designed to save you fuel.

Here a man checks the balance of a propeller shaft with his ears—something no test driver could do with ears or anything else. The support at each end of the shaft is pivoted and held in a hori-



Checking silver surface coating of Plymouth headlamp. Silver is stripped off, precipitated and weighed

Chrysler

zontal plane by calibrated coil springs. The shaft is rotated at various speeds and the spring load is adjusted to equal the out-of-balance force of the shaft. This allows the supports to move away and break an electrical contact. A click in his headphones tells the test man when this occurs, or he can watch neon lights.

In a box with a glass front a miniature sand-storm rages as the end of



a tie rod operates, a quick way to find out just how efficient is the tie-rod seal. Near by a forty-mile gale of fuller's earth tests shock-absorber seals in similar fashion.

A hundred-pound hammer bangs merrily away on a rubber bumper block mounted on a little anvil while a counter records each bang and the endurance of a new type of exhaust pipe hanger is being tested by a rod which strikes the pipe at regular intervals, causing the hanger to flex just as it will when the driver hits a bump.

One machine clatters away jiggling gasoline lines until they fail, another is flexing brake hose to determine its endurance and a third is testing the expansion of the brake hose under pressures as high as 1,500 pounds per square inch. Here are armored chambers where propeller shafts and fly wheels can be revolved at speeds so high they explode and here are twin dynamometers to determine friction loss in transmissions. Right next door is a set-up where clutch spin is being investigated.

Fan belts are tested by running them under load. Belts which used to fail after twelve or fifteen hours now stand up for 300 hours on the same machine, due to better construction. Soon a new apparatus must be built to give the belts an endurance test in a shorter period because hours count in the laboratory. The efficiency of various types of oil filters is tested by pumping oil through each and adding carefully measured amounts of sludge at reg-

Checking propeller shaft balance, top. Center, machine which flexes hydraulic brake hose. Bottom, cathode-ray tube aids in engine tests

(Continued to page 145A)

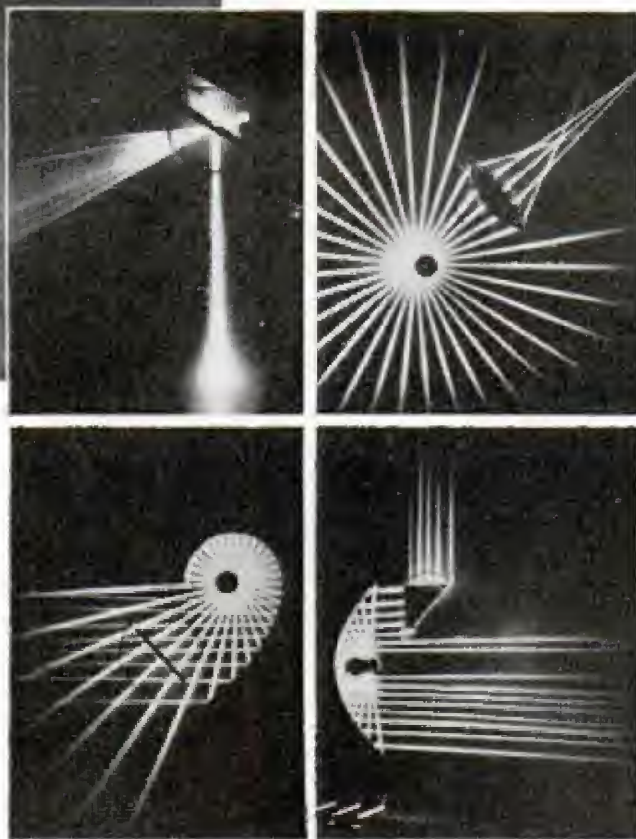
Plymouth

Prism and Lens Weave Weird Light Patterns



At the left a General Electric Institute demonstrator at Nela Park, in Cleveland, is bending light beams across a white mat with a lens. The demonstration shows the infinite possibilities of light control with lenses, prisms, mirrors and various curved reflectors. Below are a few of the fantastic patterns that can be woven with these simple instruments

How man can twist and bend light into a myriad shapes and patterns to fulfill his purpose or his whim is shown by a light-control demonstration of the General Electric Institute at Nela Park, Cleveland. Light beams are projected across a vertical white mat and then, by means of prisms and lenses, mirrors and various curved reflectors, the beams are scattered into fantastic fingers of light, focused into parallel lines or pyramids, and woven into weird patterns of high-light and shadow.



One Accident in 2,000,000 Miles on Air Lines of U.S.A.

There were seventeen accidents in 34,923,731 miles of flight on the scheduled air lines within the United States during the last half of 1937—one accident in every 2,054,337 miles. Only two resulted in deaths, however. In the same period of 1936 there had been twenty-six accidents,

four of them fatal. Nineteen passengers lost their lives in the last six months of 1936, and eighteen in the final half of 1937; since the domestic air lines rolled up 272,086,961 passenger miles in the latter period there was one passenger death every 15,115,942 passenger miles. Including the

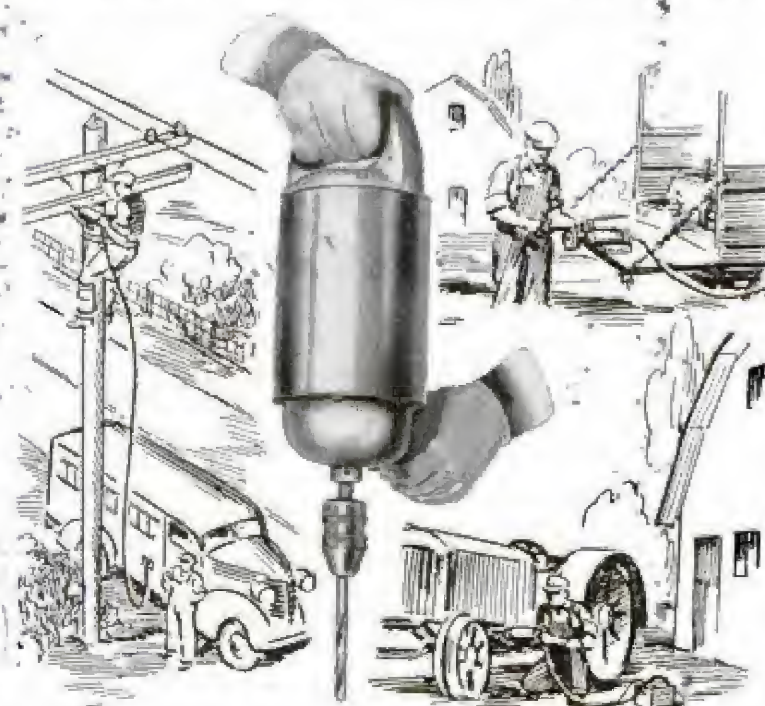
Dept. of Commerce, Bureau of Air Commerce.
Mar. 8, 1938.

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foreign extensions of American air lines, twenty-nine passengers, three pilots, three co-pilots and two crew members died in the three fatal crashes from July to December last year. Weather was the leading cause of air-line mishaps, receiving the blame for 25.45 per cent of the accidents on domestic and foreign extensions; personnel errors were the cause of 24.54 per cent, airplane failure 22.73 per cent, airport and terrain 15.91 per cent, other causes 9.09 per cent and undetermined, 2.28 per cent.

Low-Voltage Drill Is Run by Automobile Battery

Taking its power from an automobile or truck battery, a low-voltage drill and grinder makes itself useful far from the power line on farm, highway and field. It operates on six to twelve volts, and its speed, regulated merely by the pressure applied, can be high enough for grinding or drilling wood or slow enough for boring large holes in iron. The chuck takes up to a half-inch drill. It has no gears.



Linemen, farmers, machinists can work far from power line with this gearless, low-voltage drill run by a battery.

Less Grainy Film Is Sought with "Probability Machine"



Photoelectric device with which two California scientists are trying to discover means of reducing graininess of film

Two scientists at California Institute of Technology were asked to see what they could do about reducing the graininess of motion-picture film. The "probability machine" they built for that purpose turned out to be a versatile instrument; not only does it aid in the study of film grain, but it can be used in bacteria tests, or in the statistical field to smooth out the curves of a sharply fluctuating graph. Film grain consists of tiny particles of silver, which under the microscope are shown to be grouped in spots. The California scientists are trying to learn why. They pass a small section of movie film slowly under the microscope of their machine; light passing through film and microscope is reflected to a photoelectric cell whose fluctuations of light are photographed on movie film. The movie is then put on a slitted drum in the integrator, and light passed through the slit reaches another photoelectric cell. As the cell moves across the film, the light beam falls on a scale indicating the graininess.

Le Jay Mfg. Co. 1406 W. Lake St. Minneapolis

Flexible-Drive Outboard Abolishes Gears



With no interference in front of it, propeller driven by flexible shaft obtains full thrust in water

Higher propeller efficiency is claimed for an outboard motor that delivers power through a flexible drive shaft. This not only eliminates the underwater gear box, but it lowers the disturbance of water in front of the blades and thus enhances their efficiency. The two-cycle engine is air-cooled, weighs only twelve and one-half pounds and develops two horsepower at 3,400 revolutions per minute. A racing model of similar type develops eight horsepower and weighs twenty pounds.

Long-Burning Super-Match Starts Fire Easily

For starting fires in locomotives, furnaces and similar places, a special fusee, similar to those used on railroads for signaling, has been developed. The match burns for two and one-half minutes with an intense flame; sufficiently long to ignite

oil or other fuel. The fusee has a head so fitted that it may be removed. When scratched against an inner head, it ignites the fusee, which is thrown into the furnace. The match is regarded as an improvement over the lighting of oily waste.

Small Capacity Home Humidifier Operates Automatically

With a capacity of one and one-half pints per hour, a small-size humidifying unit now on the market has many adaptations in industrial and domestic fields. The unit, which operates automatically, can be tapped into the regular supply or storage tank, eliminating the necessity for installing equipment to handle the water.



Mounted inside a spun-copper bowl, which forms the housing, is a waterproof motor which drives a mechanism to break water in the bowl into a fine mist and mixes it for delivery into the air.

Transparent Plastic Oilcan Shows Contents at a Glance

Contents of an oilcan, both as to quantity and grade, can be seen at a glance in the transparent can just developed. It is made of an unbreakable plastic material and has a copper-plated flexible bottom that will not leak.



Grade and quantity of oil are always visible when the new transparent plastic oilcan is used

Samuel Jackson & Sons, Chemical Engineers

Marvel Engineering Co. 220 E. 1st St. Alameda, Calif.

Eagle Mfg. Co., Wallburg, N.C.

Universal Plastics Corp. 235 Jersey Ave. Newark, N.J.

Lucy Incubator Co. 52 Beardsley Ave. Chelsea, Mass.

Flying Fortresses Set Record on Long Journey

Six U. S. army "flying fortresses" recently set an unofficial world record for combined speed and range of flight in the large airplane class on a one-stop trip from Miami, Fla., to Buenos Aires, Argentina. The mass flight, longest and most dramatic ever undertaken by the army air corps, covered a distance of 5,260 miles. It required twenty-seven hours fifty minutes flying time and thirty-four hours fifteen minutes elapsed time, including a six and one-half hour stop at Lima, Peru. Average speed for the trip was 189 miles per hour. Average speed on the 2,565-mile hop from Lima over the towering Andes to Buenos Aires was 209.5 miles per hour.

Right, view from beneath soaring army plane. Note the four engines which drive the giant craft



A 200

Bike Turned into Motorcycle by Heavy Fork and Engine



Bicycle with special fork, front wheel and light-weight engine. Note frame brace

Conversion of the new or old bicycle into a motor-driven cycle is made possible by a special front fork which replaces the conventional fork. The fork comes complete with a heavy front wheel, fitted with a tire eighteen inches in diameter and three inches across. The motor and controls are attached to the fork, which is made of extra heavy metal to take care of strain imposed by the engine. Bore of the two-cycle motor is two and one-half inches and the stroke three and one-fourth inches. The motor is equipped with annular ball bearings. The same power unit may be placed in a specially designed frame with two wheels behind. In the V-shaped area is a floor space six feet long and thirty inches wide for delivery service.

Chas E. Miller Corp. Anderson, Ind

14/13

Chas. Thomas G. Steward Jr.
10555 Holman Ave
Los Angeles, Calif

AMERICAN DRIVERS



Top, race cars bunched at turn. Bottom, breather screen helps cool the brakes

FOREIGN cars and drivers this year are going to use American race tracks as battlefields upon which to fight for the prestige of their governments. Automobile racing has gone international. European factories devoted to building high-speed racing machines and backed by government funds have spent long months creating the finest cars possible for the coming campaign. Each team will have spare engines, spare parts, and every aid that money can buy.

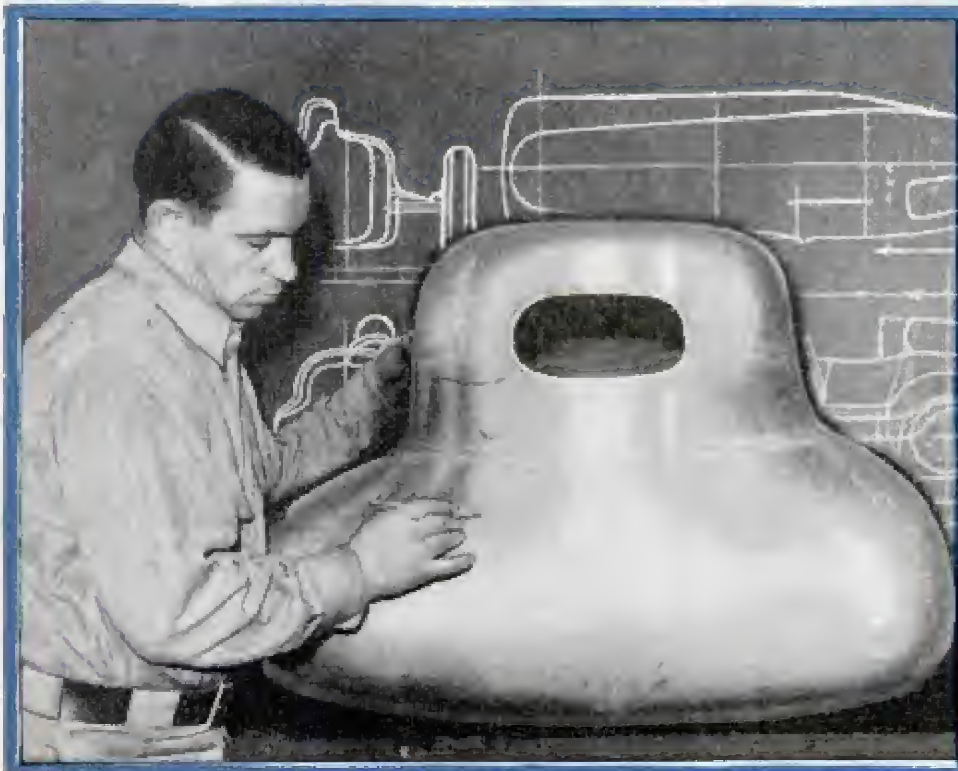
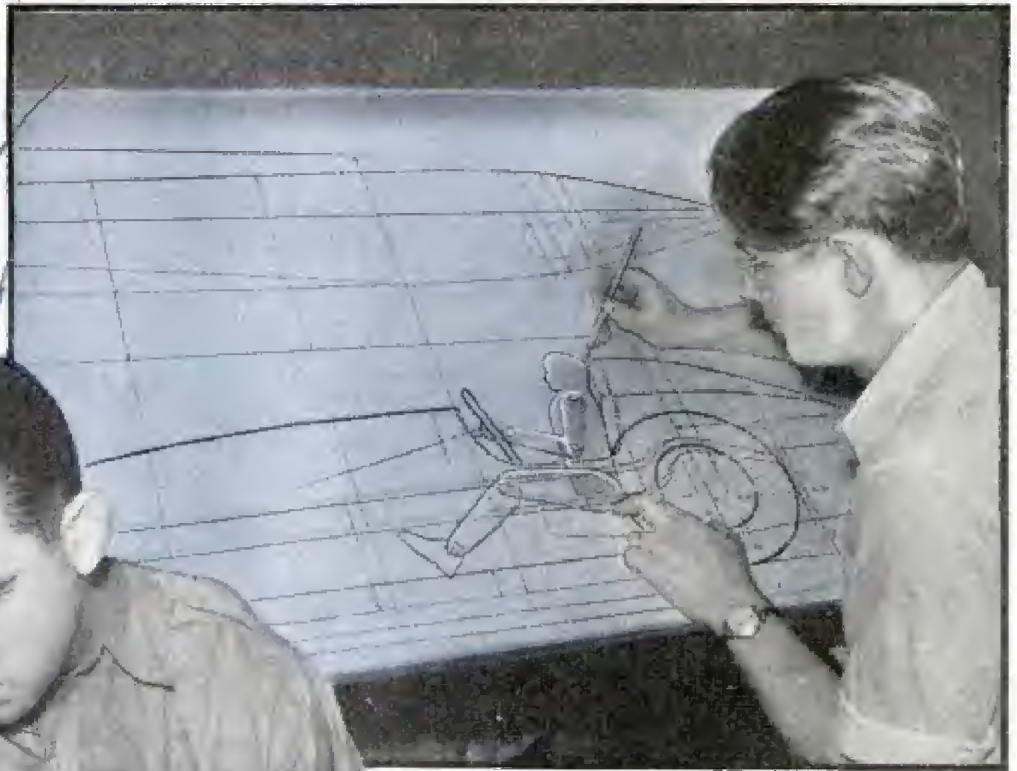
Pitted against this invasion are several dozen American cars that have been built part by part in machine shops and assembled in back-yard garages. In some cases the engines and bodies are several years old and have been rebuilt to meet the new challenge. In other cases owners and drivers have pooled their funds to put together new automobiles. If anything cracks in the trial heats they may not have time or money enough to obtain replacement parts.

Thorne Engineering Co H1131
5842. d no keep Gro.
Los Angeles, Calif

Against the WORLD

Top, celluloid model of driver's body on drawing board shows proportions for cockpit. Center, shaping racing model. Bottom, marking openings in body for radiators

Perkins
Spencer



Unequal as the competition appears, almost anything can happen. Car for car, the American entries usually have been fastest in speedway racing in the past. In road racing they have been woefully slow. The reason is that America always has been interested in speedway racing while in Europe road racing with its rougher stretches and trickier turns has been more popular. Each continent specialized in the kind of car best for its kind of track. America put a premium on speed, while Europe generally favored good brakes, good springing, and good shifting, as well as a good engine.

These two brands of racing have been brought together by new rules and specifications that are intended to give every



Indianapolis. Year by year, speeds have been climbing. This year the leading drivers agree that the winner will have to drive faster than ever. Barring accidents that would slow the pace, they think that the winner will have to average at least 115 miles per hour and that he may have to drive 120 miles per hour for the 500 miles. Counting pit stops, this means that he will have to drive about five miles per hour faster than his average while he is on the track.

Big time racing psychology is not to drive as fast as you can, but as

fast as you must. The man who gets in front tries to stay in front by increasing his pace when he is challenged. Instead of racing against time he races against competition. The reason, of course, is that every extra mile per hour added to high

driver a more even chance on either kind of track. This year riding mechanics are not required, hence drivers will ride alone to save the weight. Drivers using old two-man cars will deck the mechanic's seat over and those building new cars are using one-man bodies. The international rules require that the body be thirty-three and one-half inches wide. Motors may be as large as 274 cubic inches, if unsupercharged, or are limited to 181 cubic inches with supercharging. There are no restrictions on the kind or amount of fuel.

In the case of either type of engine, pressures are going to be so high that some of the drivers are planning to use new mixtures of alcohol and benzol as fuel. Compression ratios as high as sixteen to one may be tried in some of the unsupercharged engines, resulting in such extreme pressures that high-grade gasoline is no longer a suitable fuel, even when held down with copious amounts of lead.

The first battle of the season is scheduled Memorial Day at Indianapolis, the annual 500-mile classic of the racing world. Any of a dozen American veterans of this race stand an excellent chance of winning, or the checkered flag may record a European victory. At Roosevelt Raceway, the Long Island road course, Europeans are given high chances of winning the races usually held later in the year.

But the highest speeds will be made at



Top, Duray and four-cylinder engine he will place in his car. Bottom, Petillo, right, examining new crank shaft for engine

Kelly

see Feb. 19 38 - 178.

14173 Del. Charles Allen, 3212 25th St.
 Maritime Ave
 POPULAR MECHANICS
 Los Angeles Belanger Special 869

speed increases the chances of mechanical failure. No driver wants to break down and drop out of the race because he was showing off, when he might have been able to hold his lead by playing as safely as he could.

Every driver has his own peculiar driving habits on the track. Lap after lap you will see a certain car swing close to the outer wall and then recover as it comes down the stretch. On the turns you will observe that one driver always hits the "corner" low at the same place and then guns the motor as he gets half way through. The fastest way to get around at Indianapolis, taking about seventy-three seconds to lap the two and a half miles, is to go down the stretch with the motor wide open, turning up to 140 miles per hour or better. Then, just as the car starts entering the turn and the driver has started cocking the wheels around, he backs off the



Top, streamline body of racing car. Center, smoothing off cooling fins projecting from oil tank. Bottom, oil tank slung under car

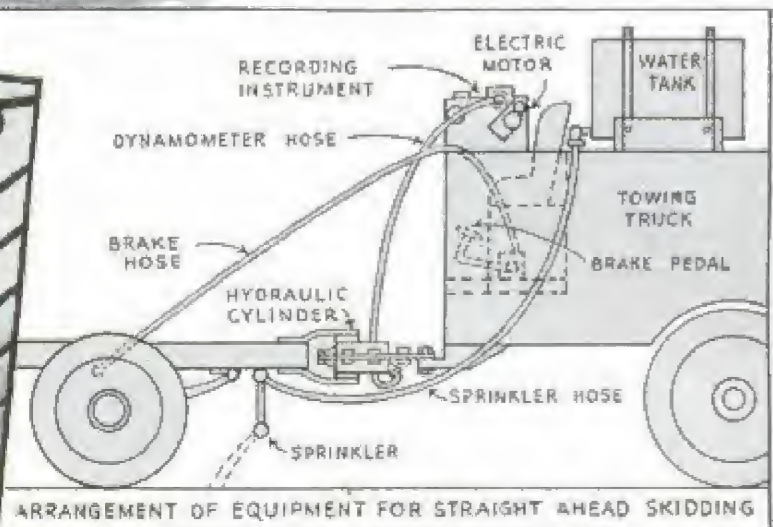
throttle far enough to drop his engine down to almost half speed. Right now the car is traveling far too fast for safety and has started to drift up toward the outer rail. In ordinary hands it would be impossible to prevent a crash. But as the car starts to drift, carried along by its own centrifugal force, the driver clamps down on the accelerator again and fights this force with more power, overcoming it with the driving force of his rear wheels. Stepping on the gas keeps the car on the track and al-

(Continued to page 149A)

Skidding Trailer Helps to Build Safer Tires

DANGER of skidding is about to be lessened for millions of motorists as the result of a two-year trailer trip over a route only two miles long. This trailer was designed and built for the purpose of studying the skidding action of automobile tires. Engineers started at rock bottom, with an absolutely bald tire, smooth as glass and about as resistant to skidding on a wet pavement. They ended with a brand new tire tread design which, they believe, represents more really scientific knowledge about skidding than

Top, watching result of a skid test. Center, truck and trailer hookup. Bottom, left, tread developed by tests. Right, sketch of test equipment



any previous tread. The trailer is a two-wheeled cart or dolly, towed by a truck. It carried, during the test, a load of iron bars so that the tires supported the same weight as if they were being used on an automobile. The trailer was coupled to a truck through a hydraulic dynamometer, which is simply an oil-filled cylinder fastened to the trailer by a yoke and contain-

ing a piston against which another yoke, attached to the truck, pulls. A line ran from the dynamometer cylinder to a calibrated pressure-recording device, a modified steam-engine indicator. Variation in pressure against the piston caused a corresponding variation in pressure in the oil system, which was recorded on a motor-driven chart as an irregular curve, while

cont. Walter E. Covert, 1932 Florida Ave. Akron, Ohio

a second recording pen made a mark on the paper for every revolution of the wheel carrying the test tire and a third counted revolutions of the idling trailer tire. On the truck were steel barrels carrying water for spraying in front of the test tire to wet the pavement for "rainy-day" tests. It took several months to decide on a tread and a year of similar testing to perfect the basic design. To control noises and other factors, such refinements as the rounding of sharp angles formed by the grooves and the adding of ribs at the shoulders were introduced. The research on skidding emphasized several factors important to the motorist. Foremost is the necessity for avoiding sudden application of brakes. Tests showed that skidding is influenced greatly by such things as the type of road surface, kind of grout used between bricks, amount of moisture on the road, presence of a dust film on the roadway and the speed. Many motorists believe that their tires are roughened by tread design so that the sharp edges will grip the road better. The edges themselves have little holding power. They aid by breaking through any film of lubricant, water or slush and providing a clean surface for the tread to grip. The sole function of a tread design in minimizing skids is to wipe the pavement dry, so that the rubber can get a grip. Water is a lubricant for rubber, just as oil is for metal and it must be removed before skidding can be prevented.

Speed Camera Splits Lightning into Eleven Flashes



Lower photograph taken by ordinary camera shows one bright flash, while high-speed camera recorded several parallel strokes

What the human eye and the ordinary camera see as a single flash of lightning may be a dozen swift strokes. The General Electric company turned a high-speed camera on the Empire State building during an electrical storm and caught a series of lightning tracks of similar pattern on the film. Actually there were eleven parallel strokes in thirty-six hundredths of a second.

Oil-Burning Heater Installed in Trailer to Convert Old Coal or Wood Unit



Coal or wood-burning heaters for the trailer can be converted into oil burners by installing a unit now available. Complete in itself, it requires no fittings or piping, and is readily removed when necessary to use the heater for burning trash. The oil tank is detachable for filling conveniently.

Sky Camera Has Keen Eye

So keen is a lens just developed for mapping and photography from the air that it increases the scope of the aerial camera by three times. With it, the flying cameraman at an altitude of one mile can take a picture clearly showing every individual railroad tie in a two-mile circle below.

Bausch & Lomb
Apt. 100
Chicago, Ill.

Ideal Engineering Co.
4119 Lake Ave. Minneapolis

RICHES *from the*



even converting tons of coal into tons of diamonds could scarcely be more remarkable than the amazing feat of chemical magic by which man today squeezes wealth from the air we breathe—wealth in the form of nitrogen, a substance more precious than either gold or diamonds.

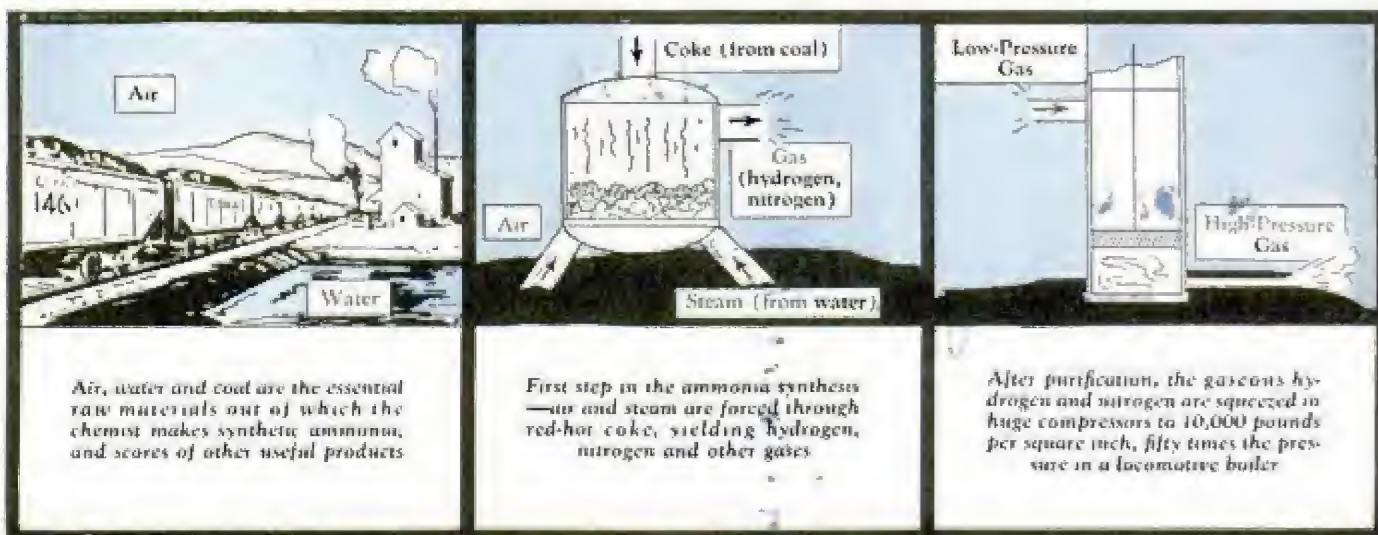
The story of nitrogen is an astonishing tale of human achievement interwoven with touches of irony and even of comedy. Wars have been fought over nitrogen, yet 20,000,000 tons of it rest in the air above each square mile of the earth's surface. Every clover field and manure heap is a nitrogen factory, yet nitrogen has been transported thousands of miles and nations have clamored to buy it, offering fancy prices for something as abundant and seemingly as free as air.

THERE'S gold in the ocean—about \$10,000,000 worth in each cubic mile of sea water. If you found tomorrow how to extract it inexpensively, you might become the richest person alive. You would also make world history by altering the entire course of civilization.

Important as such a process might be, however, reclaiming gold from water or

Many consider the nitrogen in the air wholly useless. Everyone knows we need oxygen to live, but not everyone realizes that nitrogen is just as important to life—so important, in fact, that without it we would starve. Why?

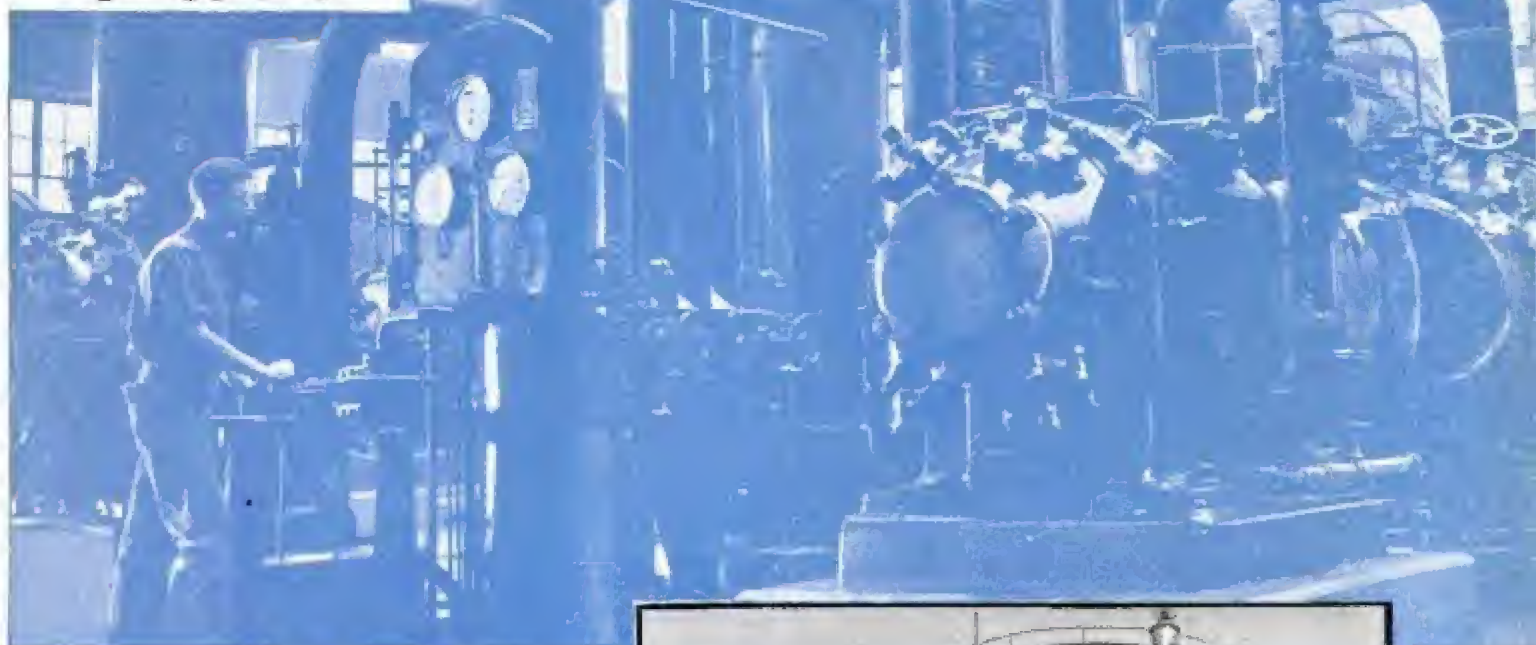
The answer was supplied about a century ago by a German chemist who proved that all plants live and grow because of



Step-by-step processes in converting water, air and coal into ammonia in which the nitrogen is locked up ready for use. Top, charging machine for water gas generator

A 32

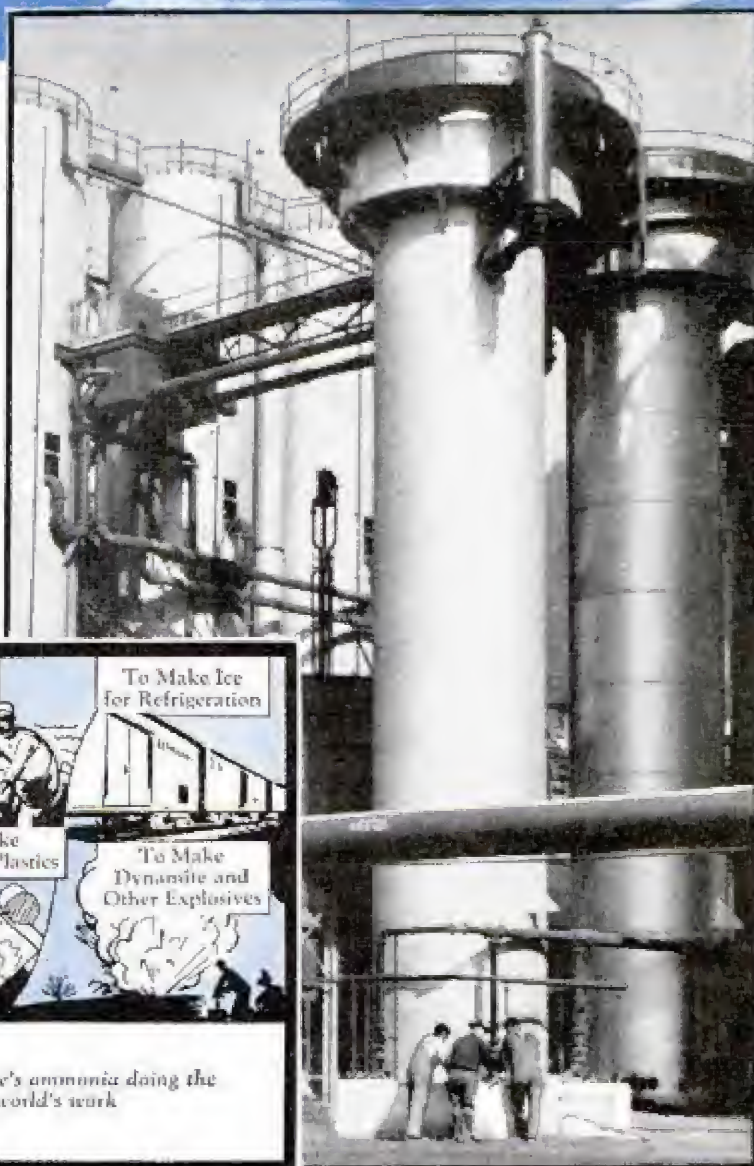
AIR



Bella W. Va.

certain soil chemicals of which nitrogen is the most important. Feed the ground with nitrogenous substances, he found, and you make two blades of grass, or even three or four, grow where but one grew before. And yet, this life-giving substance, when isolated as an element about a century previously, at first was given a French name meaning "without life," due to its inertness.

If left to herself, Mother Nature supplies enough nitrogen to the



Hydrogen and Nitrogen

Red-Hot Iron

Ammonia

When the high-pressure gas is forced through granules of hot iron—called the "catalyst"—the nitrogen is "fixed," or combines with the hydrogen to form ammonia. The steel walls of this "converter" are eight inches thick

To Fertilize Cotton

To Make Ice for Refrigeration

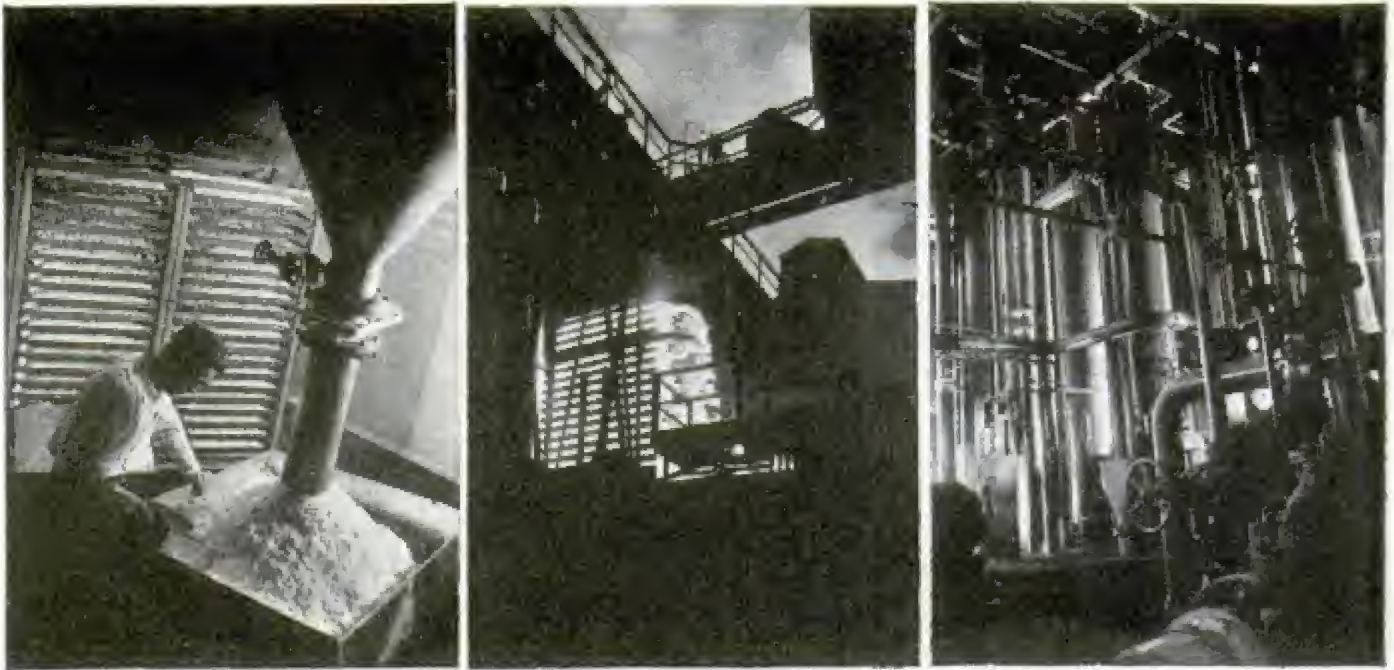
To Make Dyes and Plastics

To Make Dynamite and Other Explosives

—And here's ammonia doing the world's work

Photographs courtesy du Pont Company

Plant which removes hydrogen sulfide in water gas for use in manufacture of ammonia.
Top, machine which compresses gas in making synthetic ammonia



Base for "Lucite" plastic ready to go into dryers. Center, incandescent coke coming from ovens of ammonia plant of du Pont Company at Belle, W. Va. Right, here carbon monoxide reacts with steam to produce carbon dioxide and hydrogen, the latter a component of ammonia

soil. Certain legumes, like clover, carry tiny nitrogen factories in their roots. Rain and snow also bring nitrogen down from the air. But when man disturbs the delicate balance of nature by intensive cultivation of the soil, the nitrogen is used faster than it can be replaced. So, since man depletes the earth of this life-giving substance by artificial means, he must restore it by artificial means if the soil is to continue to produce.

When he first discovered nitrogen was an indispensable fertilizer, he supplied it by treating the ground with manure. But as the population grew, this source of nitrogen was insufficient, so man began growing legume crops to augment the supply. The season he grew clover, however, he couldn't grow corn, so this remedy reduced soil productivity to that extent.

Still the population increased and, as it increased, the amount of land available for agriculture decreased because millions of acres of good farm land were occupied by cities, railroads, highways and other developments of a modern civilization. So man was pinched between two millstones—a growing population and a decreasing amount of land for farming.

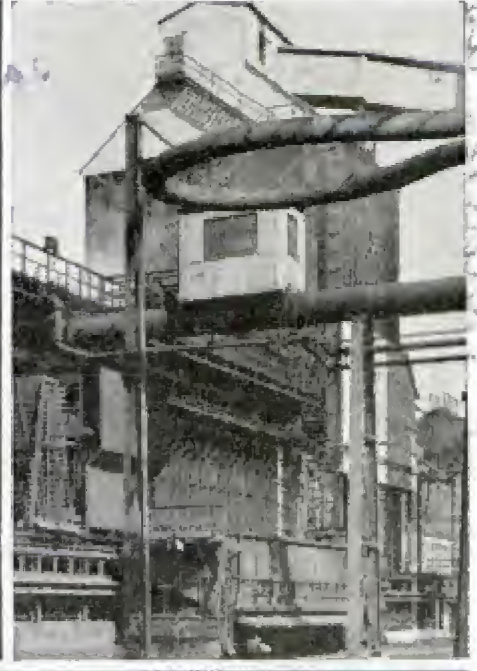
His only salvation was to replace the lost fertility of the soil or starve. There was plenty of potash, lime, sulphur and other ingredients but despite the pitifully

small amount of nitrogen required per acre each year—about eighty pounds to 2,000,000 pounds of top soil in an acre of land usually is sufficient—there was not enough.

Geologists helped solve the problem temporarily. Sodium nitrate can be crystallized out of nitrate-bearing rocks, and this sodium nitrate can be assimilated by the soil. The greatest source, in fact, the only source, of these rocks was in the vast deserts of Chile, Bolivia and Peru. In these arid acres were hundreds of millions of



Part of fleet of anhydrous ammonia and alcohol tank cars at du Pont plant at Belle, W. Va.

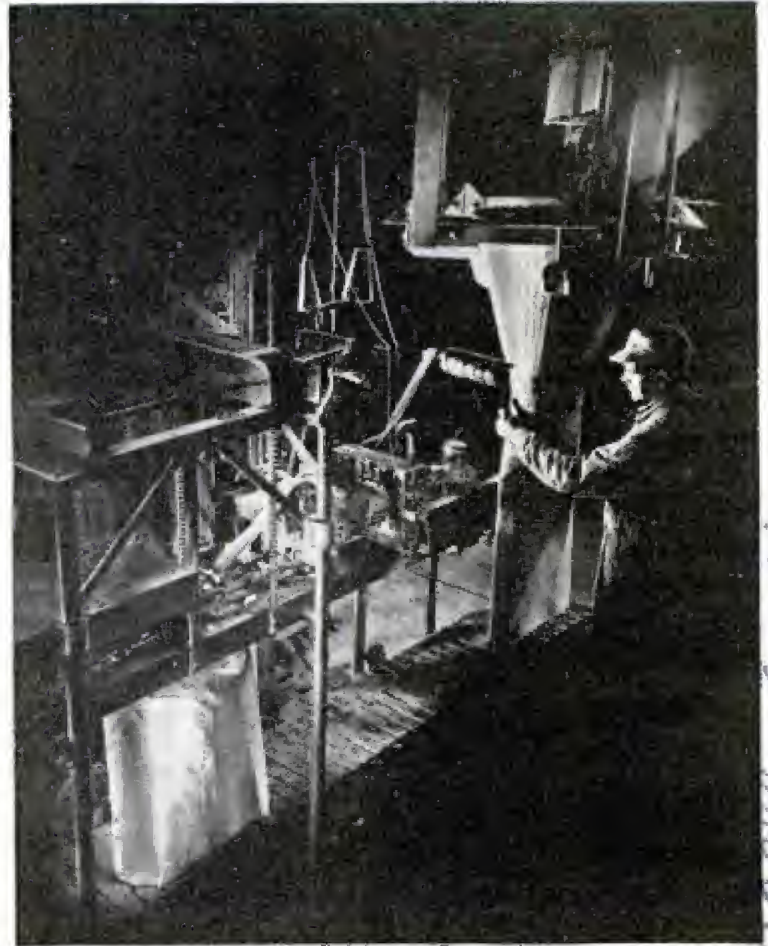


tons of rock which could turn other lands into green acres of waving corn and wheat.

So the rush to South America began. Windjammers were built for the "nitrate run" around the Horn. In one year, nearly 3,000,000 tons of nitrate of soda were exported from Chile. Ancient towns which went to sleep when the Spaniards left became busy cities and ports. The nitrate nations prospered.

Then came a demand for still more nitrogen. An Italian chemist treated glycerin with nitric and sulphuric acids and obtained an oily, unstable liquid which, upon little provocation, exploded with a loud and satisfying bang, a bang produced when nitrogen atoms broke off diplomatic relations with the other elements. At first, nitroglycerin was only a chemical curiosity, then Alfred Nobel of peace prize fame blended mineral earths with the very unstable nitroglycerin and tamed the fierce nitrogen atoms. The result was dynamite, one of the great civilizing forces of modern times.

Soon the same nitrogen which made the earth produce food crops was also blowing holes in the earth from which arose dams, docks, bridges and skyscrapers. After while other chemists nitrated other sub-



Bagging fertilizer at ammonia plant. Top, left, scrubbers which remove carbon dioxide in water gas. Center, gas generator blasting directly to the air, a process for removing unnecessary gases in making ammonia. Right, coke ovens at ammonia plant

stances. From cellulose they got guncotton, from toluol they got T.N.T., and from the same family they produced cordite and blasting gelatin—all with nitrogen.

Bread or bombs, tilling or killing, pro-

(Continued to page 120A)

weight in the process; engineers of the radio division of Westinghouse Electric & Manufacturing company applied the internal heat of radio short waves to a fourteen-pound ham and it was cooked to a delicate flavor in twenty minutes, with a loss of only a half pound. Industries are putting short waves in harness, too. Furniture makers find they can dry out wood by radio heat treatment in a half hour, while outdoor seasoning takes years and kiln drying sometimes causes cracking. Automobile crankshafts are "skin tempered" in five seconds by radio waves, which follow the surface of the metal and harden it without affecting its internal resilience. Radio is even applied to preventing worm infestation in grain; an oscillator sets up a radio field and the heat kills both worms and eggs.

H 210
Anti-Aircraft Gun Showers Sky with Spray of Steel from Belt



Russian sailor sights his anti-aircraft gun on an aerial target and sends a shower of steel skyward during maneuvers of the Soviet Amur fleet

With a belt of cartridges swinging in a deadly arc from his anti-aircraft gun, the Russian sailor is ready to spray the sky with steel. This modern equipment of the Soviet Amur fleet was displayed in recent demonstrations marking the twentieth anniversary of the Red Army and Navy.

H 251
Giant Bearing Will Support Million-Pound Telescope



Designed to carry the 1,000,000-pound load of the world's largest telescope on Mt. Palomar, Calif., a 158-ton bearing looks like a giant washer from which a large "U" has been cut. So precise were the manufacturing calculations that final machining called for a job within five-thousandths of an inch of the specifications. The bearing is forty-three feet across and fifty-three inches thick, eight times larger than the bearing supporting the mirror of the Mt. Wilson telescope.

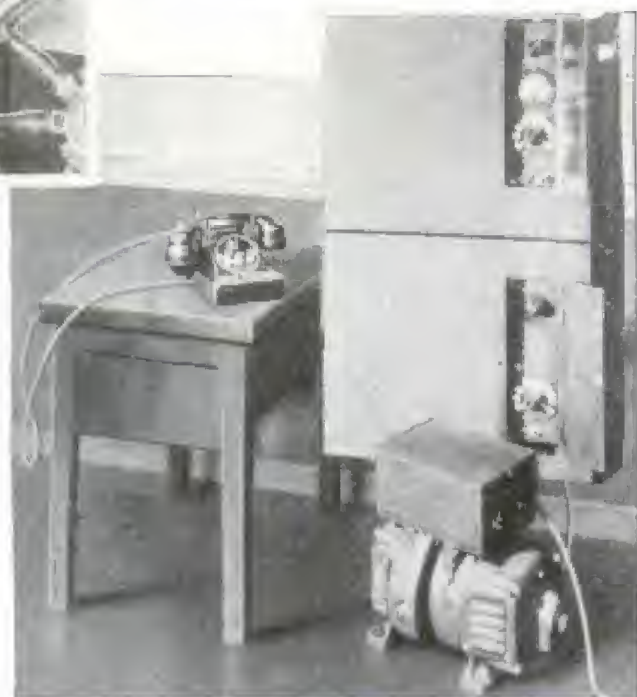
Small Craft Radiophone Calls Shore or Ships



small rotary converter may be employed to deliver the necessary 110-volt alternating current from the vessel's direct-current supply. Both the transmitter-receiver combination and the converter may be installed below decks, while the telephone instrument may be placed in wheelhouse, the owner's stateroom or other con-

Left, radiophone in use. Inset, the phone with switches. Bottom, radiophone equipment aboard small craft

COMMUNICATION between small craft cruising in coastal waters and the shore may be speeded up by new radiophone equipment. Offered by Western Electric, the fifty-watt equipment incorporates features which simplify operation and extend the scope of performance. Nine frequencies are provided for communicating through shore stations which serve to link the telephones aboard vessels with those ashore in the Bell system. A tenth frequency may be used either for communicating directly with the Coast Guard service or for ship-to-ship communication without working through intermediate shore stations. Through the facilities of shore stations established for the purpose, the equipment enables persons cruising along the coast or in harbors and inlets to call the office or the home ashore. Likewise, persons ashore may pick up the nearest Bell telephone and call those aboard vessels suitably equipped. Shore stations for this service are located at Boston, New York, Miami, Los Angeles, San Francisco and Seattle, with one at Norfolk in the stages of completion. A selective ringer makes it possible for the operator ashore to "dial" the particular boat for which a call is intended. The telephone bell aboard that boat rings in response to this call. Transmitter and receiver are mounted on a common chassis which may be fastened to a bulkhead or to the deck. A



venient location. Additional handsets may be provided for other desirable locations. The equipment requires no trained personnel to operate it. Regulations of the federal communications commission permit operation of this equipment by persons holding radiotelephone third-class operator's license, obtained by passing an examination requiring elementary knowledge of radio laws and familiarity with the method of operating the equipment.

Travel Time of Firing Pin Cut to Increase Accuracy of Shot

Split seconds mean the difference between a hit and a miss to the hunter. To obtain greater accuracy and speed, a rifle

Western Electric Co. 195 Broadway New York

H 321
2311. 2.16 lbs. 0.16

Springfield
Sporter

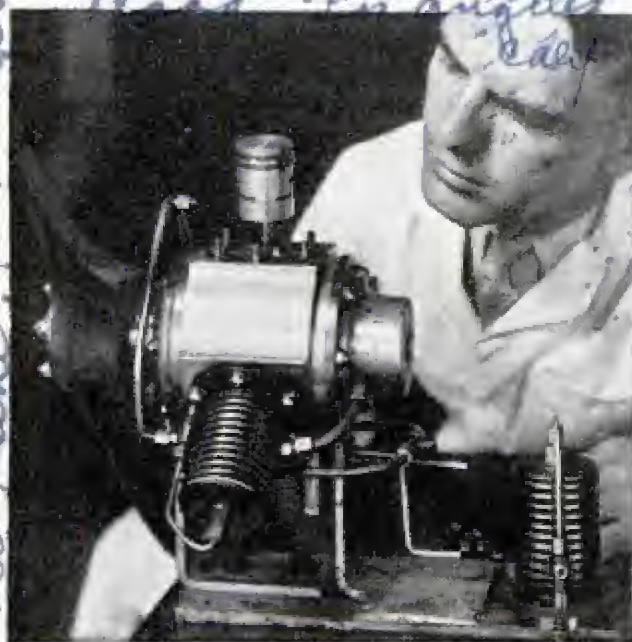
H 29-3

manufacturer has shortened the travel of the firing pin from five-eighths of an inch to five-sixteenths. The lag between release of the firing pin and its impact is an almost infinitesimal part of a second, yet the fraction is important, for the projectile leaves the muzzle at a speed of perhaps 3,000 feet per second.

H 238

Lightweight Diesel Engine Develops Six Horsepower

Developing six and one-third horsepower at 2,000 revolutions per minute, a diminutive Diesel engine built by a Los Angeles man weighs only eighteen pounds. It is a three-cylinder, two-cycle motor, each piston weighing three ounces, having a one and one-half inch diameter and one and seven-eighths inch stroke. The compression is 460 pounds with a ratio of sixteen to one.



Here is a three-cylinder midge Diesel engine, weighing only eighteen pounds.

Law Violators Take Lesson from Traffic in a Model City



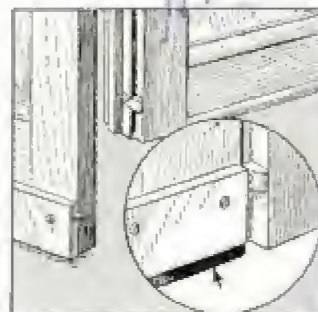
First offenders attend this traffic school in Hamburg, Germany, to learn lessons in safe driving by watching traffic movements in a model city

Policemen in Hamburg, Germany, don't need to ask a second offender against the traffic regulations "Where did you learn to drive?" After a first violation the driver is sent to a special school where traffic rules and safe practices are taught. A miniature city is laid out on a large circular table around which the traffic violators sit. A member of the police department, acting as instructor, illustrates his lecture by reconstructing traffic situations with model vehicles.

H 272

Under-Door Draft Is Stopped by Automatic Strip

Drafts underneath doors can be checked effectively by an automatic strip attached to the base of the door on either side. When the door is closed, the strip springs down automatically and seals the space between the bottom of the door and the floor or rug. As the door opens, immediately the strip springs up into its former position, clearing the floor and avoiding any rubbing. The seal strip is of metal and fabricated material.



Charles Keene, % Wernicke

2020 San Fernando

Standard 11-00 6 in am 2 H. in
Lower Bldg. Cleveland
Maysteel Specialties
Cleveland 449 Terminal

Window Opened by Crank Is Locked at All Positions



Turning crank to lift or lower either pane of window. It locks in position when crank is released

Burglarproof windows that are raised and lowered by a hand crank have just been put on the market. The window has no sash, and automatically locks in any position when the crank is released. Turning the crank lifts or lowers either the upper or lower pane separately, and a special weatherstrip is used instead of sash to seal out cold.

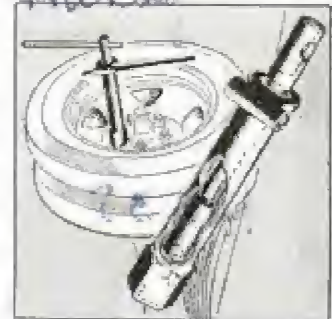
Tourists Ride Elevator to Peak of Whiteface Mountain

You can reach the 4,867-foot summit of Whiteface Mountain in the Adirondacks by a walk of only 424 feet. An eight-mile automobile road takes tourists within a few hundred feet of the summit; from that point you can walk into the heart of the mountain by way of a tunnel five feet wide and seven feet high, bored 424 feet to the foot of a vertical shaft. There an elevator was installed recently to lift pas-

sengers the remaining 271 feet to the top of the mountain. Its shaft is eleven and one-half feet square.

Double Wrench for Dual Wheels Loosens "Frozen" Bolts

Even the rustiest, "frozen" hub bolts on the dual wheels of a truck yield to a double wrench invented recently. One wrench is inside the other. The inner one holds the inner nut like a vise while the outer wrench loosens the outside nut. The tool weighs twelve pounds and is built to stand a severe strain.



Satan Rides on Steamer Funnel as Emblem of Its Owners

Symbolic of fire and brimstone is the emblem carried on funnels of the Union Sulphur company steamships. Mounted against the yellow stacks of these sulphur-carrying vessels are red figures of Satan, with horned head and pointed tail and uplifted fork.



On the yellow funnel of this Union Sulphur company steamer rides a red Satan, symbolic of the cargo.

Tagging of Sardines Solves Migration Puzzle

By tagging sardines, the California state department of fish and game is solving some of the mysteries regarding movements of the fish. Metal tags are inserted in the abdominal cavity, a scalpel being used to make the small incision. Then the sardine is returned to the water. Tags recovered recently in the canneries of Southern California reveal that the sardine travels 1,000 miles, sometimes more, from British Columbia to the Terminal Island fish harbor in Southern California. Elec-

Montebello Calif.



Top, left, inserting metal tag. Right, sieving the findings of magnets to recover tags. Bottom, weighing, smelling and finger-testing contents of sardine cans in inspection laboratory

tric magnets are used to recover the metal tags from the meal produced by grinding the fish. This fish meal is used for fertilizer and for dog, cat and cattle feed. Findings of the magnets are sieved and the tags reclaimed. Identification markings on the tags establish the locality in which the sardine was released. Severe tests by state experts are made at the sardine canneries

to safeguard public health. One of these is the odor test, in which the contents of a can are rubbed to determine texture of fish and thoroughness of cooking. Then, by smelling the can, the experts detect presence of odors of deterioration. The sampling, or testing, on a busy day represents 20,000 tons of fish and the inspectors work night and day.

469
Cml. W. A. Brown, Editorial Service Bureau,
Eastman Kodak Co. 344 State Rochdale, Ill.



NATURE PHOTOS *in Your*



Close-ups count in nature pictures. Bird picture was made with portrait attachment. Try zoo snapshots first, and butterfly portraits for "home work"

ern swamps. Others stay nearer home, picturing the birds splashing in a bath on the lawn, or gathering for bread crumbs scattered from the kitchen door. Many delight in picturing domestic animals, chickens and ducks, sheep and cows—and the excellence of their work often demonstrates that it is the skill of the photographer, rather than the rarity of his subject,

WHETHER it's moose in the northern woods or ducklings in the barnyard pool, amateur photographers are discovering there is endless enjoyment and an endless field in "hunting" native birds and animals in America.

Some of them seek wild life in remote places—deer, mountain sheep and goats in the west, moose and grizzlies in northern forests, cranes and rattlesnakes in south-

that produces exceptional pictures.

Most amateur photographers, beginning nature work, choose the hard way. They ignore the easy nature subjects around them, the everyday birds, the friendly squirrels in the park, the familiar flowers and trees, and instead pursue wild creatures that are difficult even for nature specialists with years of experience.

When you begin to do nature pictures,



OWN BACK YARD

you should avoid subjects that require long, skilled stalking. Instead, develop your technique thoroughly on the easiest available subjects, "graduating" later to those that call for more subtlety and skill. The ordinary amateur camera serves splendidly during the learning period; if you develop into a nature specialist, you can obtain cameras with wider operating range and more flexibility of use on very small subjects.

Most nature subjects derive interest from a "close-up" viewpoint. Such a viewpoint can be obtained by setting up the camera, focusing on a spot where the subject is sure to be sooner or later, and tripping the shutter from a distance by a cord or other remote-control device.

This is the only practical method for many pictures that involve noisy climbing or must be taken from unusual angles, such as snapshots of birds on their nests—and you can pick out a com-



Swans in city lagoons and deer in national parks are easy and always pleasing subjects. Stalking a mouse calls for either a patient photographer or a clever shutter-release "trap"



fortable spot to await your subject.

Arrangements are simple. First, you need a clamp to mount the camera firmly and tilt it to the required angle. A tripod might tip when the release string is pulled. Firm tree branches or similar supports serve as mounting for the clamp.

After the camera is focused accurately on the spot where your subject is to appear, the release cord is attached to the trip lever of the shutter. There are many varieties of shutters and camera constructions, so it is impossible to describe an arrangement to fit all. However, the essential requirement is that the cord pull smoothly without jamming. It is a good idea to arrange a small guide block or eyelet under the camera so the release cord is led straight down in the direction the shutter trip lever moves.

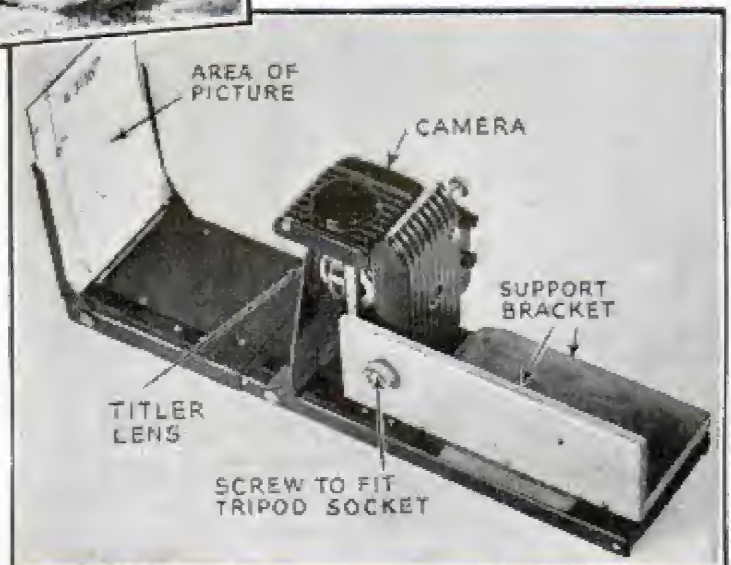
Bait may be placed to coax an animal or bird on the spot—nuts, grain or small fruit. Run the release cord to a point some distance away where you can watch without being obtrusive, and pull the cord at the right moment.

It is also possible to arrange bait so that the wild subject snaps its own picture. For example, a rubber band can be attached



to the release cord, and pegged down with the bait in such fashion that when the bait is nibbled or pecked away, the band slips off its peg and gives the cord a tug, tripping the shutter. When arranging such a set-up, keep a lens cap or black cloth over the camera lens, to avoid accidental exposures. Do not arrange the release so that the subject gives a direct tug on the cord, for a strong animal might be able to pull hard enough to injure the delicate camera shutter mechanism.

For small subjects, it is necessary to work close. Most good focusing cameras of standard amateur types will focus as near as four feet, and many as near as three feet six inches. Supplementary lenses such as the Kodak Portrait Attachments allow using these latter cameras at two feet six inches, and for some smaller cameras, such as the Retina, front lenses are available



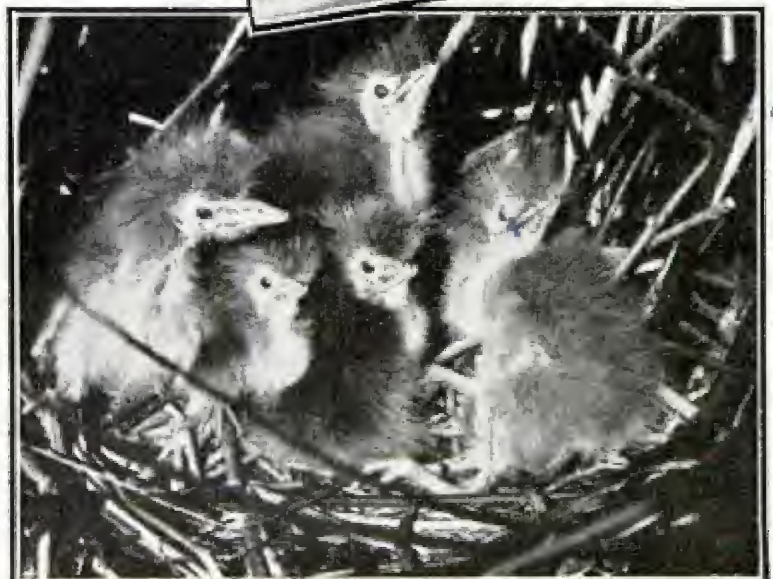
Your window sill or public park may furnish good bird pictures. Camera below is set for insect close-up

which permit snapshots much nearer than this.

The portrait attachments work at a specified distance with a fixed-focus camera, but with a focusing camera you have a choice of distances. For instance, to snap a picture at three feet with the portrait attachment mentioned above, you would set the camera lens at the ten-foot mark. Then, if you wanted to get closer and snap one at two feet six inches, you would change the lens setting to six feet. A complete table for a focusing camera would be: for a camera focused at six feet, distance from subject to lens would be two feet six inches; at eight feet, two feet nine inches; at ten feet, three feet; at fifteen feet, three feet four inches; at twenty-five feet, three feet eight inches, and at 100 feet, four feet two inches.

The nearer the camera is to the subject, the less "depth of field" or range of sharpness you have, especially with large lens openings, and this means that if your subject moves the least bit nearer or farther away, it will be out of focus and "fuzzy." Too, the closer you work the less area the camera includes.

(Continued to page 116A)



You can usually catch a bird at the "water hole" and persuade a squirrel to pose with a nut. Center picture, prefacing a fishing trip, is a variation from the ordinary nature picture. Too young to leave the nest, birds in lower right were snapped at night with flash bulb

Radio Newspaper System in First Tests



Removing sheet from receiver after test of facsimile transmission system

Preliminary tests have been made of a radio facsimile system by means of which a newspaper may be delivered into the home. The tests were made in a New York studio, pictures and reading matter being transmitted and received. A 710-kilocycle channel was used, but plans call for transfer of the system to a new 100-watt eight-meter station after approval by the federal communications commission. Daily eight-meter broadcasts will be made after experimental work has been completed.

Siphon-Feed Paint Container and Cover Fit Spray Gun



Providing a positive and simple means of attaching siphon-feed containers to spray guns, a new aluminum paint container and cover have been developed. The cover is a light-weight stamping which locks in any

position on the circumference of the aluminum container. The lip of the lock has a flange which fits over the rim of the container and seals against leakage with a fluid-resisting gasket. The quart container has straight sides which are a decided advantage over the narrow neck type and is reinforced by a steel band around the lip, with the aluminum spun over it. There are no obstructions, such as rivets, inside it to catch wiping cloths. The cover will fit standard quart paint cans of leading manufacturers and permits the use of paint cans usually discarded.

H 236

Ignition Analyzer Tests Parts in Thirty Seconds

Claimed to be one of the fastest troubleshooting devices on the market, a new ignition analyzer tests parts and electrical units on the automobile in thirty seconds. Tests are made without removing the part from the vehicle. Weighing less than three pounds, the analyzer is made of aluminum. It has a four-range voltmeter and a three-range zero adjustment ammeter. Scales are easy to read, making it unnecessary for the operator to possess expert mechanical knowledge. One feature of the device is



Testing ignition wiring and parts with newly developed analyzing device

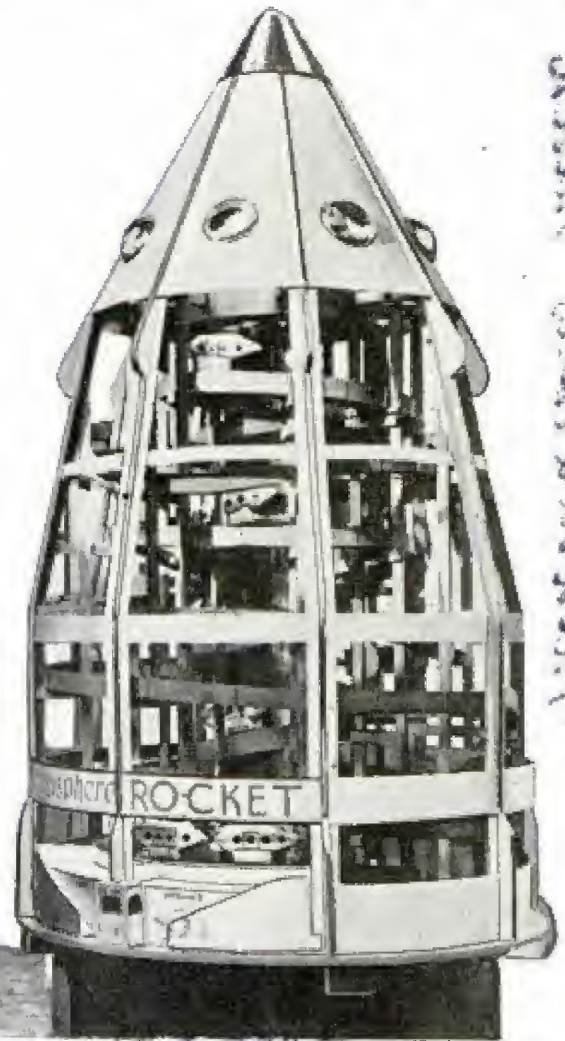
an audible vibrator for testing operation of the points without removing any part of the car. The light bulb of the analyzer is a combination ignition timing flow tester and coil circuit tester. The neon tube is used in four different ways, one being for quick location of lost high-tension current due to faulty wiring or dirty or cracked distributor head.

The Alexander
Mulburn Co, 1493
W. Baltimore
Baltimore

I. Tell & Meter Co
3216 Baring St.

Stratosphere Rocket Is Latest of Thrill Rides

Designed to give a new thrill, a "stratosphere rocket" is the latest amusement device in England. The rocket will take passengers spiraling eighty feet into the air at high speed. A model of the ride device was on exhibition recently in London.



This model of the thrilling Stratosphere Rocket ride was on exhibition recently at a London show

Six-Screw Liners of Future to Cross Sea in Half Week

To meet the competition of the transatlantic flying boats, marine engineers predict that superliners even larger than the "Normandie" and "Queen Mary" will be built, capable of carrying passengers to Europe in eighty-four hours. They would have to cruise at thirty-five to thirty-seven knots, compared with the thirty knots of present ships, and this speed would require longer hulls—perhaps 1,350 feet. The engineers suggest this could be accomplished by a turbo-electric drive, using six propellers, three on each side of the center. The liner would have to carry 11,000 tons of fuel oil and provide for ballasting the tanks with sea water as the oil is used to keep the vessel trimmed.

Cableless Tractor Hauling Bus Is Driven from Its Trailer

Hauled by a tractor without a cab, a Seattle passenger bus is driven from the trailer. All the controls are at the forward end of the thirty-passenger trailer, the arrangement being made possible by a circular turntable set horizontally on the rear of the tractor chassis. This turntable links tractor and trailer without any "play," serves as a housing for the control connections and acts as a universal joint to provide for steering, for inequalities on uneven roads, and to eliminate twisting and racking. Bus and tractor are thirty-two feet over all, but the turntable allows the vehicle to turn a complete circle in a twenty-foot radius. The total weight is only 8,800 pounds compared with 12,000 pounds for a conventional bus of similar capacity.



Bus driver's cab is at forward end of trailer, the controls passing through a circular turntable at rear of tractor

☐ Erosion will wear North America down to a general level of 200 feet above the sea in about 18,000,000 years, geologists estimate.

and George M. Yost,
310 Central Terminal

Compressed air
Jan 1908

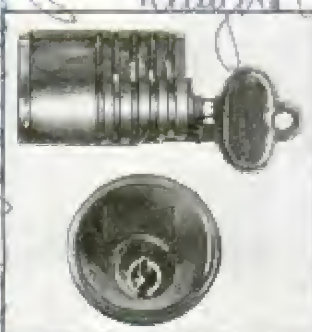
Patient Administers the Gas by Controlling Hand Bulb



Dentist's patient gains confidence when allowed to control administration of gas by hand bulb

Dental patients can now administer the gas themselves while the dentist goes about his work. Shown at a recent convention of dentists was an instrument intended to instill confidence and overcome the patient's fear of gas by letting him control the flow with a hand bulb. The gas is a mixture of nitrous oxide and air. The patient takes only enough to induce a state of analgesia, becoming insensitive to pain but not completely unconscious.

Locks Are Made Non-Pickable by Special Cylinder



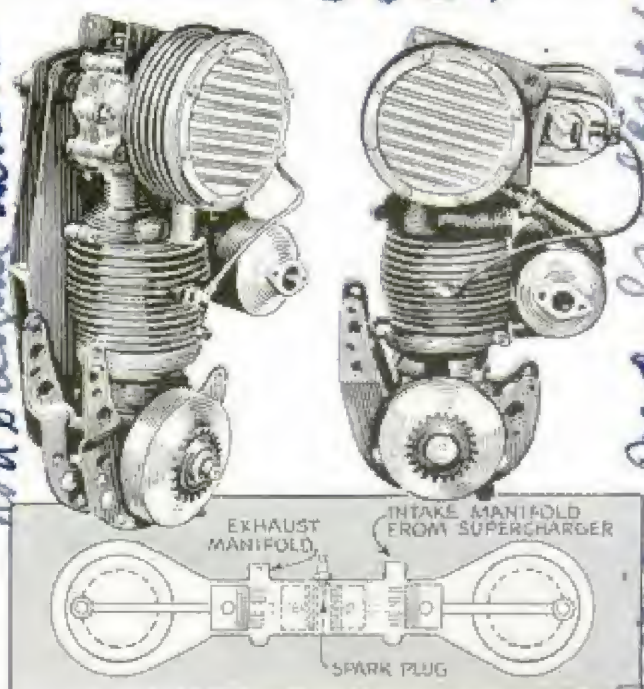
Tests indicating that a newly invented cylinder makes locks non-pickable have been completed recently by Underwriters' Laboratories, regarded as the bureau of stand-

ards of the insurance companies. Invented by Samuel Segal, inventor of the Segal jimmyproof lock, the device can be installed on any lock now in use by merely replacing the present cylinder. Then the lock can be opened only by the owner's key, according to the makers. The invention is applicable to automobiles, filing cabinets, vending machines, bank vaults, strong boxes and all types of furniture.

H 260.

Double-Piston Engine Increases Motorcycle's Speed

Latest of engines designed to give German motorcycles more speed than any others in Europe is an Imperia, a double-piston, two-stroke built along the lines of the Junkers airplane engines. This motor looks like the heads of two small two-stroke motors have been removed and the units re-assembled, barrel to barrel, to form one engine, with a crankcase at each end. However, the cylinder is a single casting with the spark plug centrally located. Each of the crankcases contains a normal crank. Mainshafts are connected by means of sprockets and an automatically tensioned duplex chain, while on the other side of the motor, the shafts carry the driving sprocket and a supercharger. What appears to be a muffler attached to the cylinder is a container into which gas is forced before entering the cylinder. The



Two views, with cross-section sketch, of the double-piston motorcycle engine

magneto is mounted horizontally at the top of the motor and is driven from the upper mainshaft, while the rotor of the supercharger serves as a flywheel for this shaft, but the lower shaft is provided with an outside flywheel of normal design. The two aluminum alloy pistons work in opposition to each other. Thus, both approach the center of the cylinder together and insure almost perfect mechanical balance. Crankcase compression is not used, the fuel mixture being forced by the supercharger into the lower part of the cylinder through circumferentially disposed slots, which are uncovered by the descending lower piston. At the same time the ascending upper piston unmasks similar slots in the top of the cylinder and out of these the burned gases are forced by direct draught. In order to prevent mixing of new and burned gases, the inlet-port slots are designed in the shape of turbine or rotary-pump blades. Thus, the new gas is forced into the cylinder in "wedge" formation beneath the burned gases, which are driven upward. An exhaust port of increasing diameter aids in providing escaping gases with ready exit. Air cooling is used for the engine, so finning of the cylinder and of the supercharger is generous. The motor, in bench tests, developed forty brake horsepower at 5,200 revolutions per minute.

14257

New U. S. Passenger Liner to Join Atlantic Service in '40



Marine artist and painting of new 34,000-ton American liner which will ply between New York and Hamburg in 1940

First big passenger liner on the shipbuilding program of the United States Maritime Commission, a 34,000-ton vessel is under construction at Newport News, Va. Although it will not be ready for transatlantic service until 1940, its portrait already has been painted by Worden Wood, marine artist. The U. S. Lines will operate the new steamer on the New York-Hamburg route. Planned to accommodate 1,219 passengers, the ship will be 723 feet long, with a ninety-two foot beam and will have a speed of twenty-two knots.

Odd Restaurant Built Like a Zeppelin Attracts Tourists



Lights make this odd cafe especially striking at night

Closely resembling a Zeppelin, an odd dining establishment near Northampton, Mass., attracts many tourists. At night, when lights are turned on inside and the outside is illuminated with powerful floodlights, the building is a spectacular sight.

Cont. John Kaczanowicz
314 Pleasant St.
Northampton, Mass.

14 10 4

Ensl. James M. Enslow
431 W. 60th Terrace
Kansas City, Mo

DRESS UP



you continue, after placing the four cards on top of the deck, the bandits learn there are only four single rooms left, one on each floor of the building. As if to dramatize the men going to their respective rooms, you take three cards off the top of the deck one at a time, inserting one near the bottom, the second in the middle, and the third a little above it, leaving the fourth bandit on the top of the deck.

You tap the deck mysteriously as a signal for the bandits to enter their

By Claude Enslow

(Professional Magician)

2940 Forest, Kansas City, Mo

PATTER is a phase of magic frequently overlooked by the amateur magician. Yet with this simple ingredient it is possible to double entertainment value of performances. Patter is the professional term for dressing up a trick with a little story or dialogue that will enhance the audience's interest in what you are doing. In nine cases out of ten, a simple stunt with a clever story woven around it will make a bigger hit than a more difficult one presented in a grim, matter-of-fact way.

For informal, close-up work, one of my standard routines was a card trick with four jacks. It never created much of a stir among audiences. Changing its name to the Four Bandits and garnishing it with a clever story made the trick very popular. Here is the way to dramatize your movements on this trick: As the four jacks are being shown, you explain they are bandits and are on their way to a hotel (the deck) to plot a robbery. Arriving at the hotel,



Top, and center, steps in Hangman's Noose trick, showing how rope is attached. Bottom, start of trick to tie knot in circle

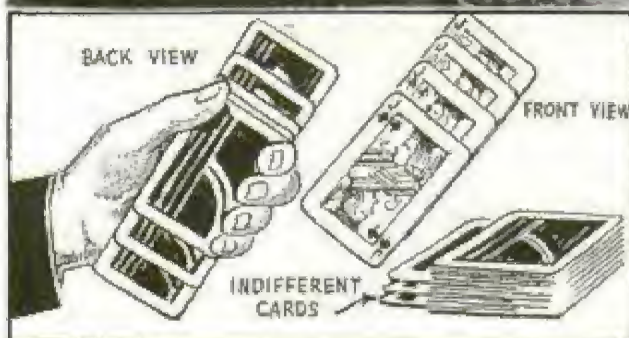
Your MAGIC TRICKS



rooms. The cards are then pushed all the way into the deck. A second signal, the audience is told, will bring the bandits to the room on the top floor where they will proceed with their plans. Again, you tap the deck and after a brief pause, turn over the four top cards and they prove to be the four bandits. When the four jacks are first shown, three different cards are concealed behind them. When the seven cards are pushed together and placed on top of the deck, the three indifferent cards will be on top and these, of course, are the ones that are inserted in the deck.



Top, ink becomes water when silk liner is pulled into handkerchief. Circle, various steps leading up to the mystifying trick



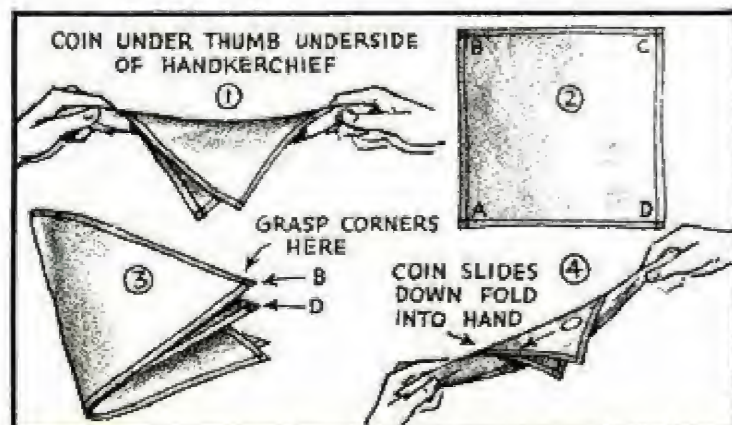
Top, explaining the Four Bandits trick. Left, how the cards are placed

You can spin your own story about the invisible hen that lays eggs at will. While doing this you show a handkerchief and a hat that is to serve as a nest for the magic hen. The handkerchief is thrown over the hat and after completing the introductory patter, you pick it up by the four corners and gently shake an egg into the hat. Showing the handkerchief on both sides, you repeat the process several times. Upon picking up the hat, however, you show it to be free of eggs.

In order to do this trick, an egg first must be blown, its contents removed by placing tiny holes in either end. An invisible string is then attached to the egg by means of a small piece of Cellophane tape. The thread also is attached to the handkerchief. The handkerchief is freely shown with the egg resting in the bottom of the hat. When the hat is covered with it, the spot where the thread is attached to the handkerchief should be nearest you. With your left hand you pick up the handkerchief at this thread point while your right

hand grasps the two corners. You then proceed to shake the egg from the handkerchief.

Another routine that lends itself well to patter is the ink-to-water trick. At the outset you show a glass of ink and as proof of its genuineness, you dip out a few drops with a spoon. The glass is covered with a handkerchief, you wave your hand over it, and presto, the ink becomes water. The secret of this clever bit of parlor magic lies



Steps in preparing handkerchief for the traveling penny stunt. Note the folding

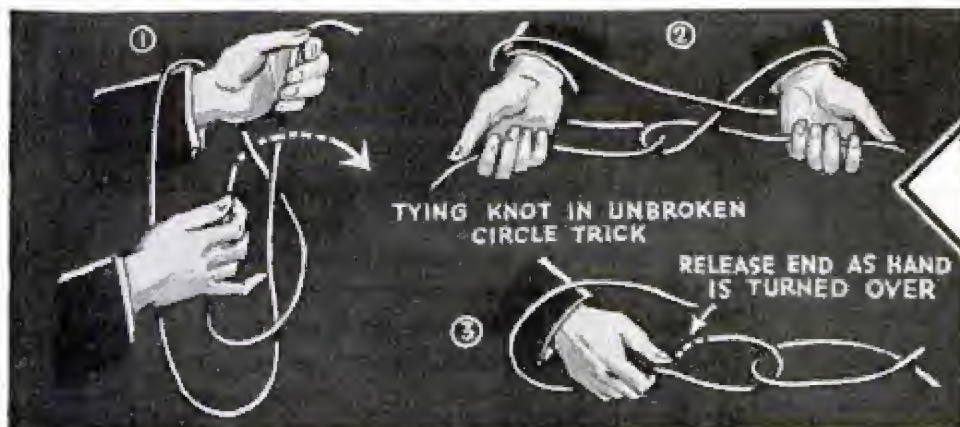
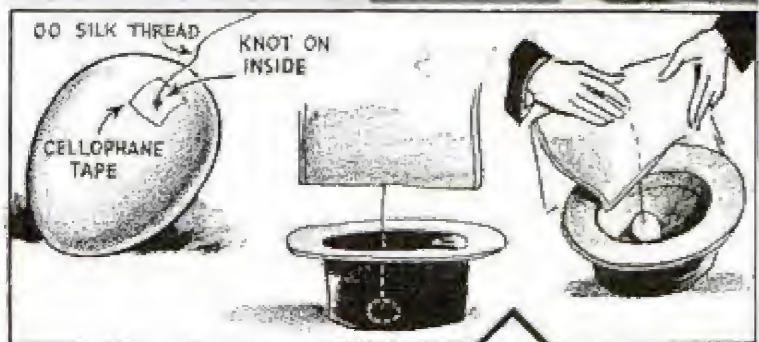
in a small effect that can be made without difficulty. A piece of dark blue silk is sewed together so it fits snugly around the inside of a glass. When it is placed in the water it will adhere to the sides and gives the appearance of ink. It may be necessary to place a piece of wire around the rim of this fake so as to stiffen it.

An invisible thread handle attached to the effect hangs over the edge of the glass toward the magician so it cannot be seen. The handkerchief covers your movements. Grasping the thread, you pull the silk fake into the folds of the handkerchief as the latter is drawn off the glass. The handkerchief containing the piece of silk is quickly put aside.

Perhaps you are wondering how you assure your audience the glass contains ink when you first show it. That's easy. You place a small amount of potassium permanganate in the back part of the spoon and this chemical will mix with the water, creating a blue fluid resembling ink. In working this trick, make sure the glass is high enough to prevent the spectators from seeing into the bottom of it.

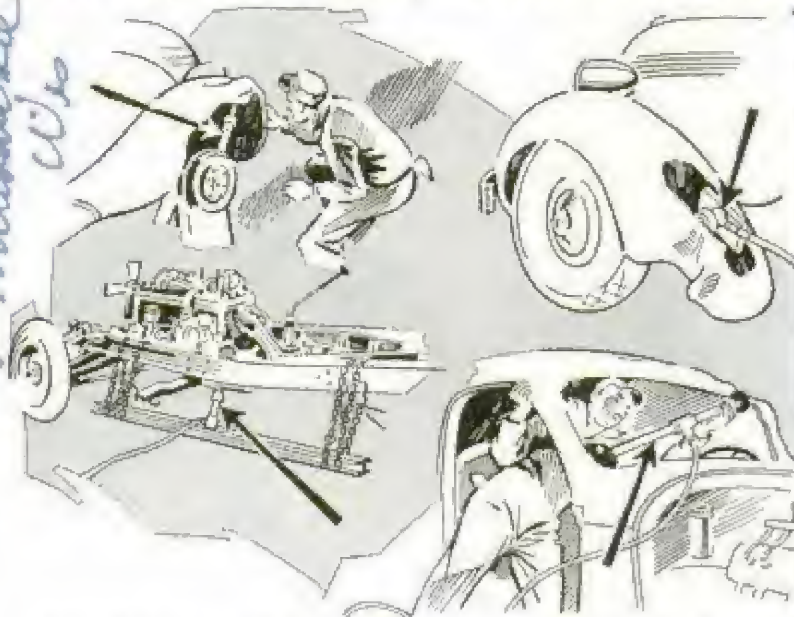
Ask your audience if it is possible to tie a knot in a circle, such as an automobile inner tube, without first cutting the circle. You probably will receive a negative reply. Of course, you dis-

(Continued to page 118A)



Top, invisible hen lays eggs at will. Center, how the magician prepares and executes the trick. Bottom, steps in unbroken circle trick. Right, how false knot is tied with handkerchief

Power of Many Men Harnessed for Small Shop

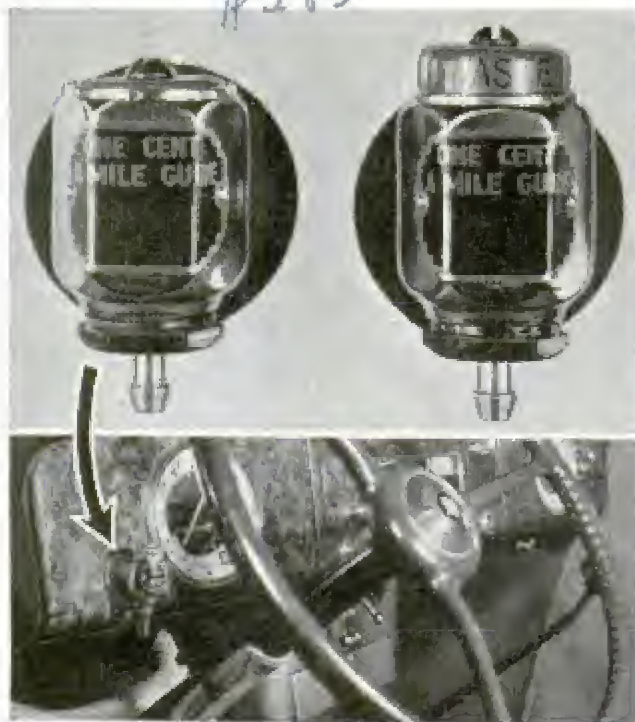


At right is the portable hydraulic power plant designed for small workshop or garage; at left, some of its applications in straightening automobile bodies, fenders and frames

Hydraulic power for the small shop is available today in a portable unit that can be put to any number of tasks. Its pump transmits power through a six-foot flexible high-pressure hose to the ten-pound ram, which can deliver pressure in any direction—up, down, sideways. A workshop on wheels, this power plant is equipped

with special attachments for work on automobile bodies. Besides straightening frames and bodies, it applies special tools for spreading springs, removing and inserting shackle studs, bolts and pins; and there is an adjustable body spoon which can be set at various angles for reshaping work in difficult locations.

Automobile Signal Warns of Waste and Saves Gasoline



Top, guide closed and open. Bottom, position of the guide on instrument panel

Easily installed on the automobile, a small gasoline waste indicator enables the driver to operate his car more efficiently, resulting in a saving on fuel. It measures the flow of gasoline in direct proportion to the vacuum in the intake manifold and automatically adjusts itself to the weight and horsepower of the car, definitely indicating each time the car is driven in such a manner as to waste fuel. Many motorists have the mistaken impression that "peak" performance driving is at a snail's pace. Peak driving is acceleration in such a manner as to utilize, rather than waste fuel. This can be done only up to a certain speed. When crowding into the manifold, by over-accelerating, more gasoline than it is possible to vaporize, which is the case when driving beyond the peak, raw gasoline is forced into the cylinders, resulting in waste. The average popular priced car will deliver around twenty miles per gallon when driven at peak performance. Us-

Blackhawk mfg Co.
5325 W. Rogers Milwaukee Wis

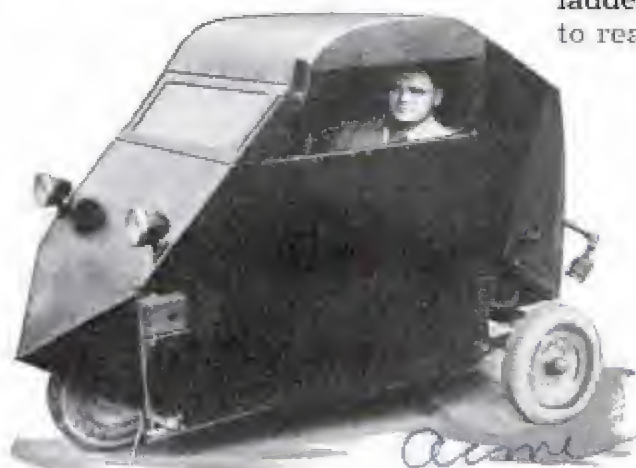
Cent. a mile inside

Motor indicators Sears City
Cloria

ing eighteen cents a gallon as the basic cost, it is a simple matter to drive these cars at a fuel cost of one cent a mile or less. All one need know is when the peak performance point has been reached. The waste indicator, called the One-Cent-a-Mile guide, remains closed as long as fuel cost does not exceed one cent per mile, indicating proper driving, but opens with a snap to display a red warning sign of "Waste" when peak performance is exceeded and fuel is being wasted. After opening, the guide automatically closes each time waste is eliminated and fuel operating cost is again normal. The device is connected to the windshield-wiper hose by means of a special T-shaped adapter and can be installed on the dash ready for use by anyone in a minute or two.

Motor Wheel Chair Coupe Has Lawnmower Engine

Charles Bancroft of Port Arthur, Tex., used to push himself around in a wheel chair, but now he rides in a motor-driven "coupe" that resembles an armored car. He built the three-wheeled vehicle himself, and equipped it with a two-horsepower lawnmower engine and a motorcycle transmission. The car can travel twenty-five miles an hour and go sixty-five miles on a gallon of gasoline.



Enclosed three-wheeler driven by lawnmower motor was built to replace a hand-propelled wheel chair

Aerial Bridge on Top of Truck Reaches Up to Street Lamp



Servicing street lamps with the "aerial bridge" which tilts steeply up to highest lamp or reaches over parked cars

Swinging in a full circle on its pedestal, an aerial ladder mounted on a motor truck can be tilted up to reach any street lamp for servicing. It can even bridge over a parked car at the curb to give easy access to the lamp. The ladder is balanced for tilting to any angle, rotates on ball bearings, is pedal locked and requires but a few seconds to extend to the average lamp.

Our Bureau of Information keeps on file the names and addresses of makers of, and dealers in, all devices described in the pages of Popular Mechanics Magazine. We are glad to furnish this information to our readers upon request, accompanied by stamped, self-addressed envelope.

The Baker-Powling Co. 2180 W. 25th Cleveland, Ohio

Making Dolls from Scrap Metal Is Latest of Hobbies



Fashioning modernistic dolls from scraps of metal.
Note completed doll at right

From scraps of metal gathered from movie studio workshop floors, one actress fashions modernistic dolls as a hobby. Scraps of tin, copper and aluminum are used. The metal is cut with heavy shears and then bent into the shape desired.

Meteorites Sought by Science Are Worth Cash to Finder

Meteorites, those "stones from heaven," are being collected by the Smithsonian Institution. While the discovery of a meteorite may not make the finder rich, it is always worth-while. Usually the return is very good for a day's work. Hundreds, perhaps thousands, of meteorites, or fragments of shooting stars, probably are scattered over the surface of the United States unnoticed. There may be some in your back yard. If you pick up a stone that seems exceptionally heavy for its size, it is well to make inquiries. Meteorites are about the heaviest of rocks. Some are pure iron and nickel. Even in an iron manufacturing district, lumps of pure iron are very rare, and if you find one anywhere else the chances are greatly in favor

of its origin in outer space. Even the so-called "stony meteorites" contain a good deal of iron and are heavy enough, compared with ordinary stones, to arouse suspicion. A good way to get corroborative evidence is to take such a stone to the grindstone and grind away a small bit of surface. If you find the exposed area speckled with iron particles, the chances are rather good that you have a meteorite. Finders should avoid injuring the surface, because it is of interest to students of meteorites. Another bit of corroborative evidence is the frequent, but not invariable streamlining of such a stone. The surface may be covered with very fine lines or furrows, all curving in one direction. These lines are "etched" by the air on the surface of the stone during its rapid fall.

"Death at the Wheel" Photo Warns of Road Perils

Taken to warn motorists of the perils of the highway, a photograph snapped recently shows Death at the wheel. The picture was posed, with the auto's driver wearing on his head a painted mask representing a skeleton. After the photo had been taken, the driver kept on the mask and rode along the highways. So frightening was the sight that other motorists gave the car a wide berth.



Depicting "Death at the Wheel," this motorist is a warning to other drivers

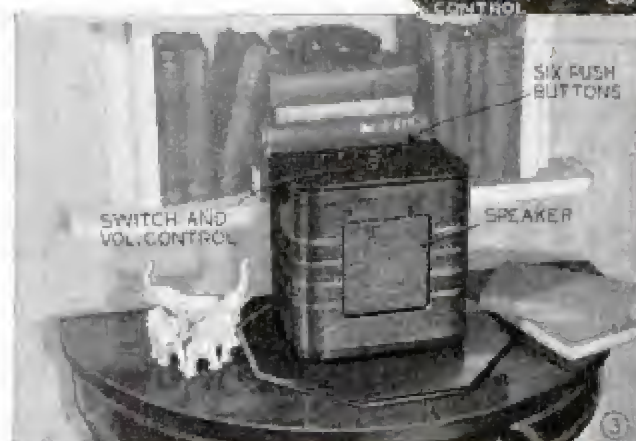
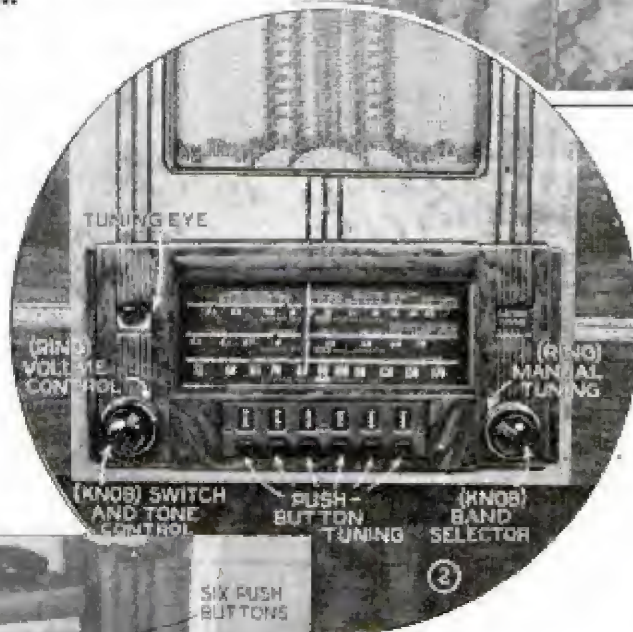
R a d i o



COMPACT *Push-Button* . . RECEIVERS

PUSH-BUTTON tuning for favorite local stations is no longer limited to large console receivers. Several models recently introduced include this desirable feature in compact cabinets designed for use in locations where space is at a premium.

A 7-tube, 3-band superheterodyne with electric tuning, magic eye and straight-line dial is shown in photo Fig. 1; a close-up of the push-button arrangement and control panel appears in Fig. 2. It is designed for electric tuning on any six local stations se-



lected, and may be manually tuned if preferred. This modern table model is housed in a cabinet 16 $\frac{3}{4}$ in. high, 18 in. wide and 10 $\frac{1}{4}$ in. deep.

Another innovation made possible by push-button tuning is a small inexpensive table-type model without a tuning dial. This

ultra-compact 4-tube a.c.-d.c. electric tuning receiver appears in photo Fig. 3. Six separate tuning buttons cover the entire broadcast range and are easily adjusted for desired locals. Other features include a cabinet 8 $\frac{1}{8}$ by 8 $\frac{1}{8}$ by 5 $\frac{5}{8}$ in. deep, built-in antenna, electro-dynamic speaker and beam-power amplification with an output of 1.5 watts.

RCA. Mfg. Co. Inc.
Camden, N. J.

Three-Tube RADIO

By G. F. Forrest

ALTHOUGH this 3-tube battery-operated receiver is designed for experimenters interested in radio direction finding, it is also suitable for receiving broadcasting stations for entertainment.

The circuit is a simple regenerative type for maximum sensitivity and can be made to give a steady beat-note as a listening aid while swinging the loop. Feedback for regeneration is obtained by means of the tapped loop and is controlled by variable resistor R_1 .

Details for the metal base and shield covers appear in Fig. 1. The front and rear panels do not completely lap over the turned-down chassis base edges, therefore holes for the insulated phone-tip jacks, and bat-

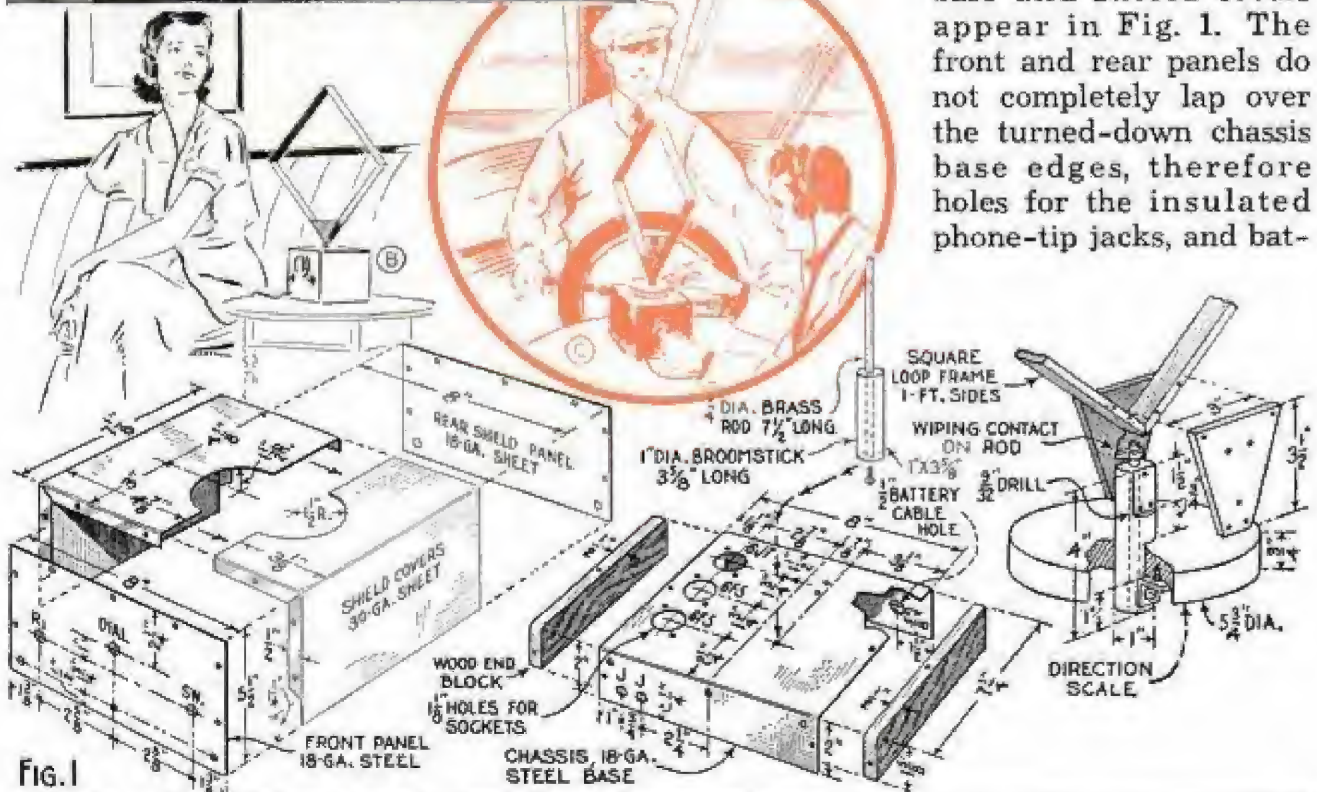


FIG. 1

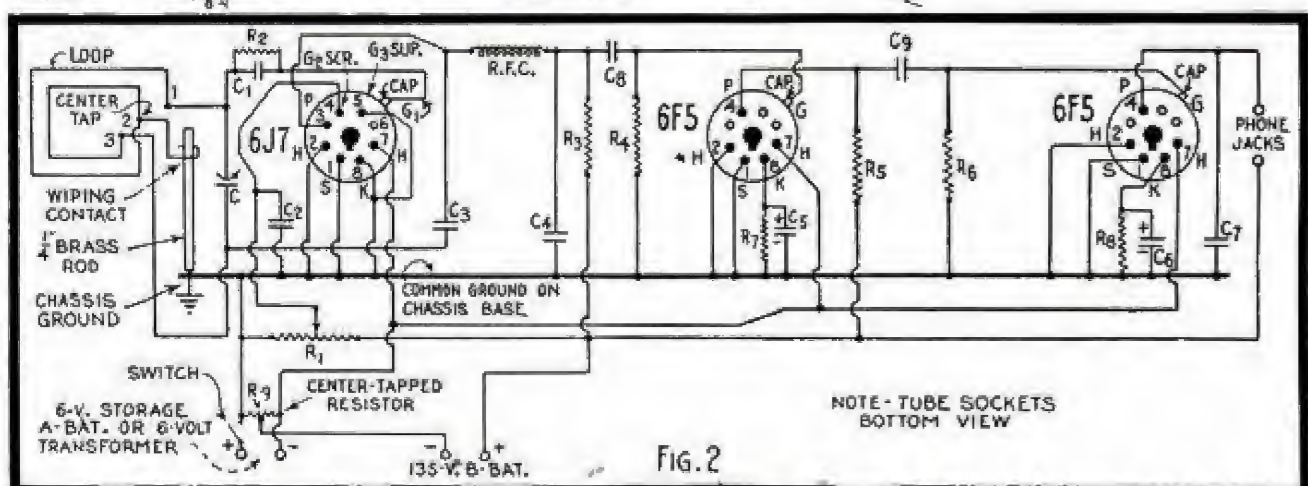


FIG. 2

DIRECTION FINDER

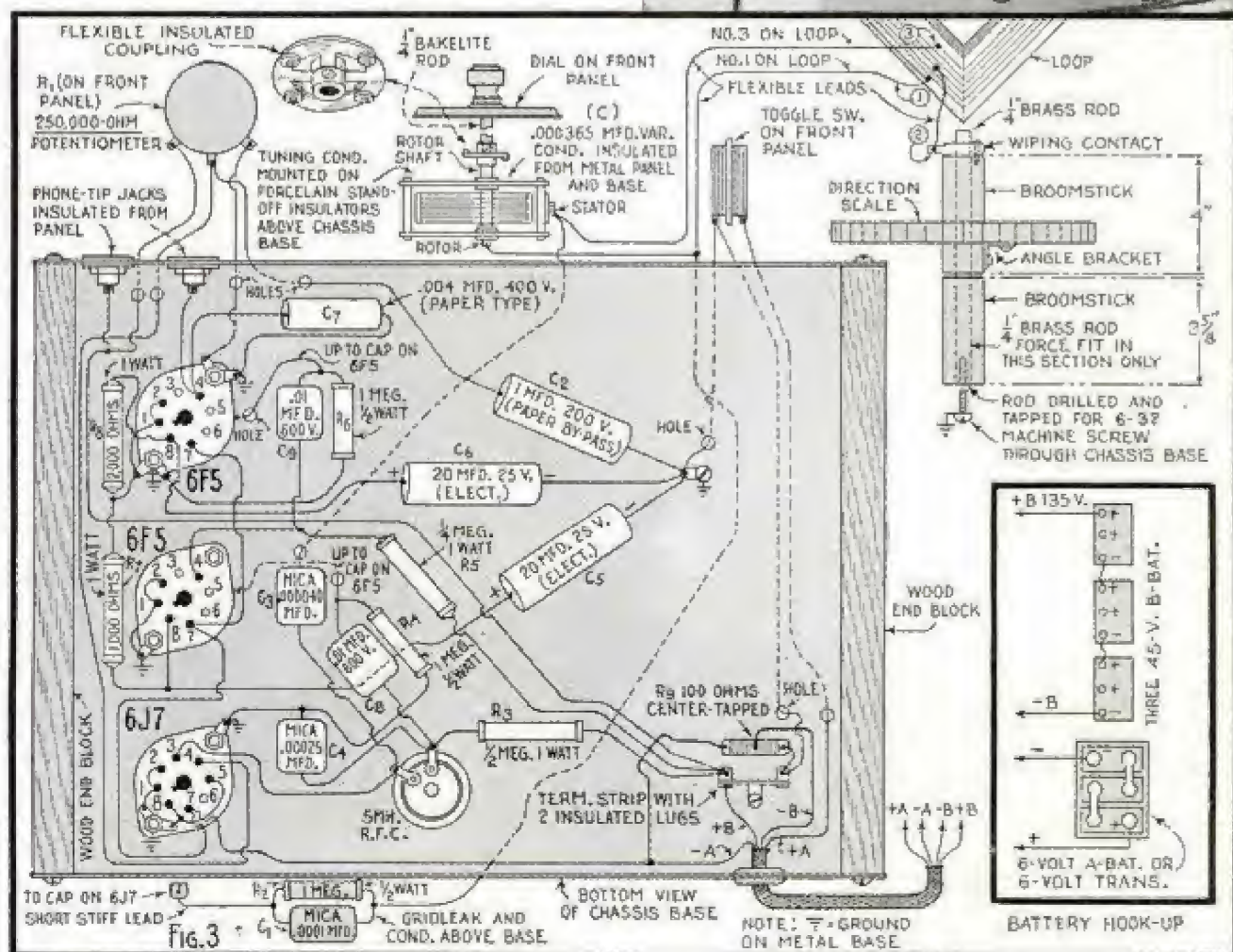
*also serves as . . .
broadcast receiver*

tery-cable, need be drilled through only one thickness of the metal.

Two yardsticks provided the material for the loop frame, each stick cut to a length of 2 ft., scored deeply across at center and then bent at a right angle to make one-half of the frame. Use pins or small brads to nail the pieces together to form a square. Wind 18 turns of No. 26 enameled-copper wire close-wound in a clockwise direction on the frame. The loop frame is then mounted as shown in Fig. 1.

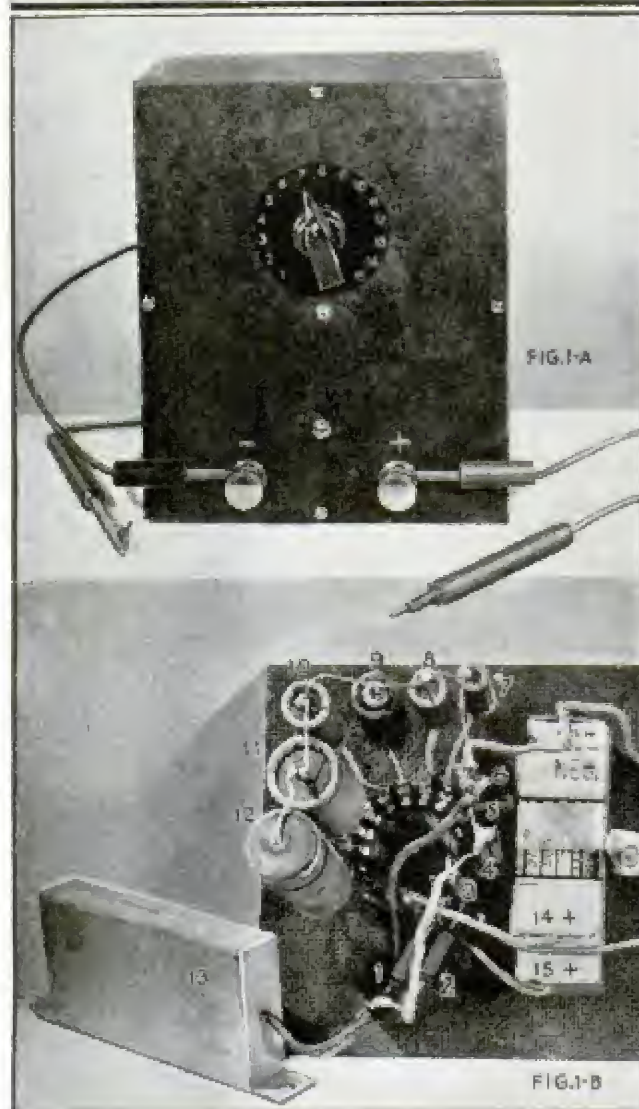
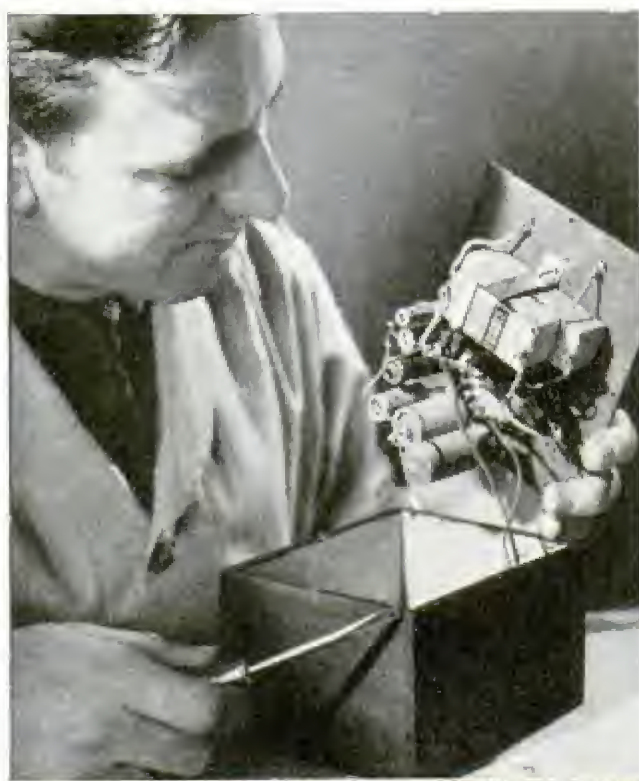
The brass rod is a force fit in the lower

(Continued to page 140A)



Simple Fixed-Condenser Substitution Tester

By M. N. Beitman



RADIO experimenters and servicemen will find this handy condenser substitute tester a versatile instrument of many applications. A 15-point single-deck switch permits instant selection of any commonly used capacity needed in radio circuits.

It is suitable for trying different capacities for best results and for substituting various size condensers for an apparently defective fixed condenser in a receiver.

The circuit appears in Fig. 1; all parts are mounted on a $\frac{1}{8}$ by 5 by 6-in. pressed-wood or Bakelite panel as shown in photo Fig. 1-B. These condensers should have a rating of 600 volts; good quality electrolytic units are employed for the 4 and 8-mfd. capacities on points 14 and 15. The polarity of these electrolytic condensers must be just as shown in the diagram. Condensers from points 13 to 6 may be of the paper type; the smaller sizes, connected at points 5 to 1, are a low-loss mica variety.

Make all connections as short as possible. The tester may be connected with either binding post to positive side of the circuit under test, except when using the 4 and 8-mfd. capacities. When these are used, follow the positive and negative post connections. A plywood box $3\frac{1}{2}$ by 5 by 6 in. houses the tester as shown in photo Fig. 1-A.

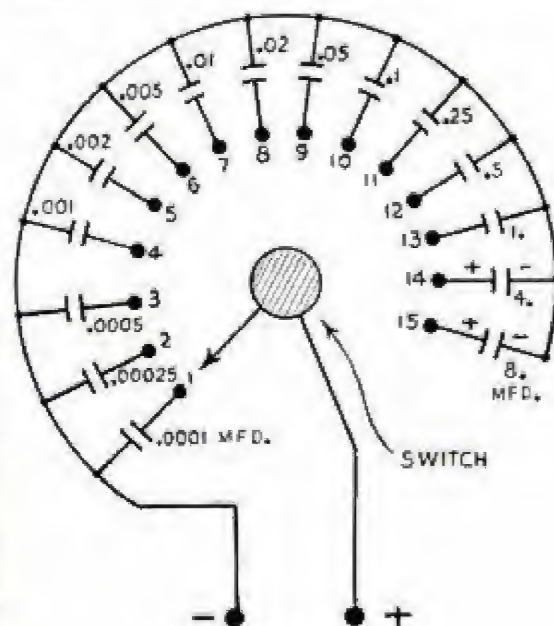


FIG. 1

Practical RADIO HINTS

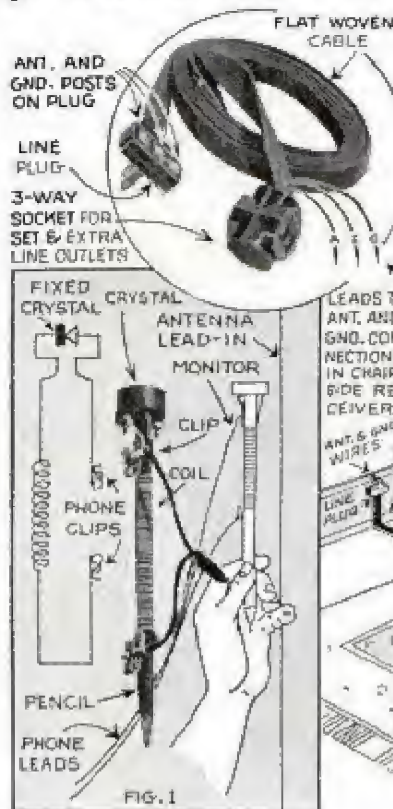
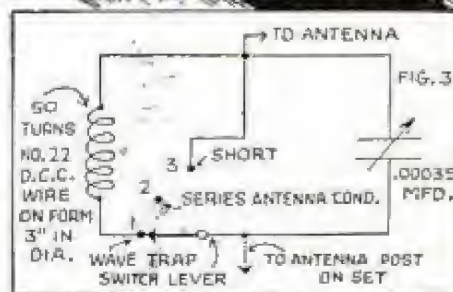
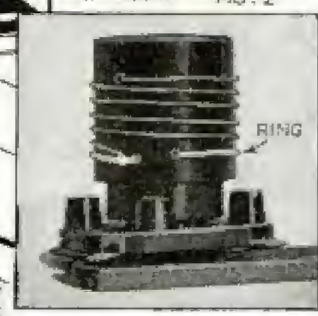
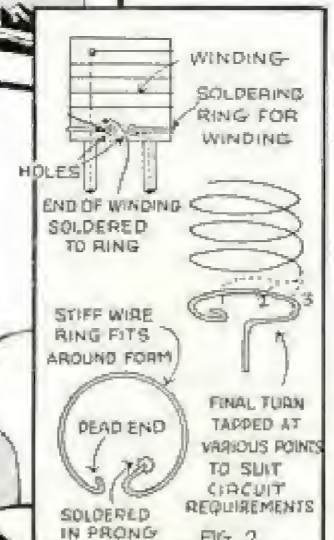


Fig. 1, two Fahnestock clips, a fixed crystal and lead pencil with metal top removed, provide coil form and all parts to make a vest-pocket monitor for phone transmitter signals. Wind sufficient turns of fine d.c.c. wire to resonate at amateur band used

Center above, flat-woven 5-wire cable unit enables owner of armchair receivers to place the set at any convenient location in the room and conceal all wiring under rugs. The cable brings power, ground and antenna leads to set as illustrated in sketch; fits snugly underneath rugs without showing and also provides a 3-way socket for lamps or other electric devices. Fig. 2, at upper right, shows an easy method to avoid tedious cut-and-try winding of high-frequency oscillator or buffer coils to determine critical fractional final-turn length necessary for operating band desired

Right, code-practice cards arranged with code on one side and corresponding letters on the other



Left, diagram Fig. 3 shows circuit details for an adjustable wave trap with 3-point switch. Tap No. 1 cuts out interfering local broadcasting stations; No. 2 serves for series antenna condenser as aid in tuning higher frequencies; No. 3 shunts trap out of antenna circuit when not required. Cardboard tubing may be used for coil form; mount coil on small baseboard and the 3-point switch on an angle bracket or Bakelite strip screwed to baseboard

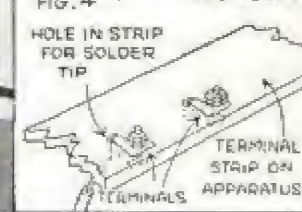
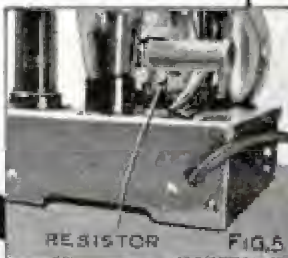
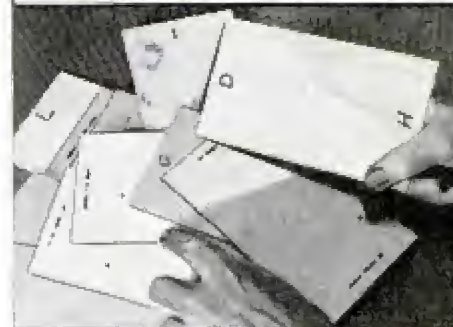


Fig. 4, handy soldering lugs cut from scrap copper or brass sheet. Photo Fig. 5 shows a 20-watt resistor wired in socket to replace burned-out ballast tube. Correct resistance is found by adding heater voltage of all tubes and subtracting this from 110. Divide result by 3; this answer times 10, is the ohm value required

Safety Tuning for Auto Set



Insert photo shows tuning buttons, dial and manual control knobs on front of set

This single-unit auto receiver can be tuned to five different stations without diverting the driver's attention from the road. A mechanical system is employed for push-button operation instead of the usual motor drive or trimmer condensers. The station received is also indicated by a pointer on the dial.

Test Set Fits Your Pocket

Small enough to carry in your pocket, this unusually compact volt-ohm-milliammeter includes all ranges required in modern radio set testing. Each voltage range has a resistance of 5,000 ohms per volt. Comes complete with test prods.



Unit-Type Amateur Transmitter

Available in 'add-a-unit' form, the assembly shown covers 5 bands with 40-watt CW output and 25 watts on phone. Features include "Les-Tet" oscillator and cathode-ray tube.



All-Purpose Portable Receiver

Without changing connections this set is designed to operate on either a 6-volt storage battery, or the 110-volt a.c. supply line in your home by merely flicking a switch.



Blueprints covering radio construction articles in past issues are available for 25 cents each; original material lists and additional information can be obtained from our Radio Department without charge upon receipt of postage.

NEXT MONTH—How to Build an Armchair Radio Cabinet. A practical, smartly styled armchair cabinet which also serves as an endtable and bookcase. It is designed to house any small 4 or 5-tube radio receiver. Also—**How to Install a Pillow Speaker and Hints for Checking Receivers with a Cathode-Ray Oscillograph**

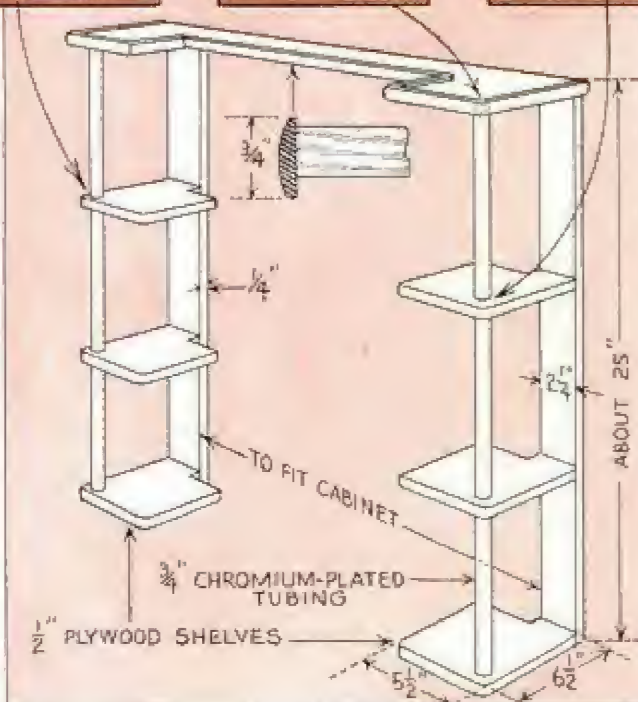


Bathroom UTILITY RACKS *give extra space*

By WAYNE C. LECKEY

IF YOU are taxed for sufficient space in the bathroom for storing numerous small items of cosmetics and such, one of these handy racks hung over the wall cabinet will allow you to keep these neatly arranged within easy reach.

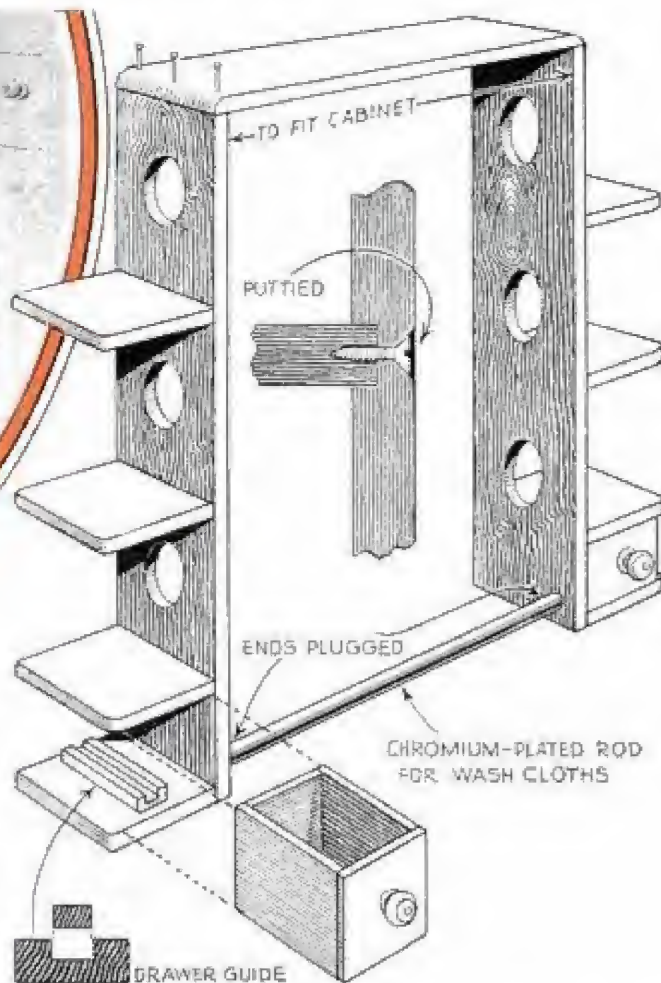
As the cabinets will be finished in enamel to match the bathroom fixtures, $\frac{1}{2}$ -in. plywood is ideal for construction. Over-all dimensions are not given as the rack should be made to fit the wall cabinet at hand. Whether your cabinet is of the flush type or one having a casing around it, either one of the designs given herein can be made to fit. One rack is made to fit snugly around the casing and rests on the top edge of the latter. In fitting to a flush-type cabinet, it is made to a size which will not interfere with the opening and closing of the door. Chromium-plated tubing uprights support the shelves of the first rack. The type of cabinet you have will determine whether the shelves need be notched. Both ends of the tubing are plugged with hardwood dowels, as shown, for





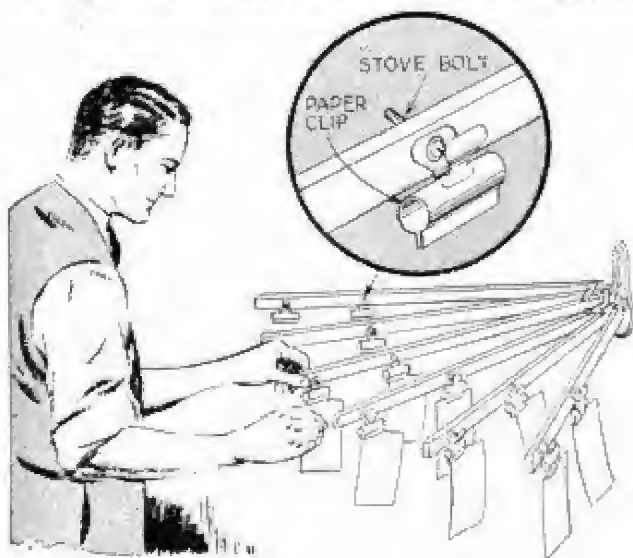
gluing to the top piece and lower shelf. A brad driven through the edge into the tubing will hold the center shelves in place. A narrow half-round molding may be mitered around the top to add a finish, if desired.

The second type of rack shown has shallow drawers which slide on small guides glued to the lower shelf. The unsupported shelves are best fitted into grooves cut in the side pieces and fastened with screws, although for the light load they are to carry, plain butt joints will do. You can bore the circular openings in the sides quickly with an expansive bit, cutting both at one time from each side to



produce a clean cut hole. A chromium-plated rod, plugged at each end with hardwood for fastening with screws, supports the rack at the bottom. The drawers are made of thin wood assembled simply with butt joints, glued and nailed. For hanging over a flush-type of cabinet, screw eyes are placed in the top of the rack through which screws are inserted into wall studs.

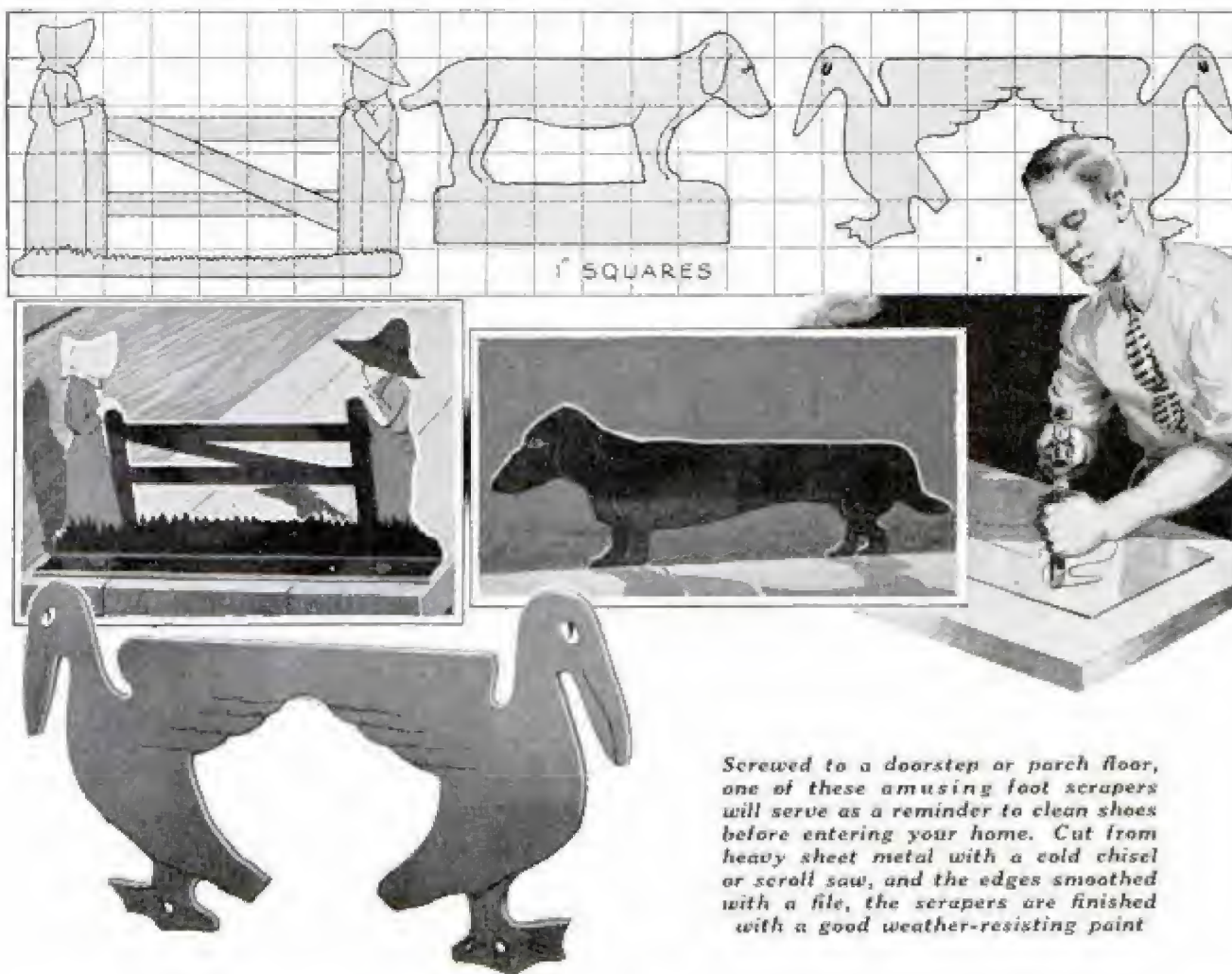
Negatives Dried on Collapsible Towel Rack in Small Space



The problem of a rack for drying photo negatives in a small space is solved by using a collapsible, kitchen-towel rack of the type shown. Paper clips bolted to the arms hold the negatives. The rack has the advantage of being portable so that it can be moved from the sink to the drying location. Two screws driven into the wall at each desired location support the rack, which is provided with slotted screw holes so that it can be removed.

❏ Old toweling wrapped around the rollers of a wringer will keep greasy clothes from staining the rubber.

Unusual Foot Scrapers of Heavy Sheet Metal



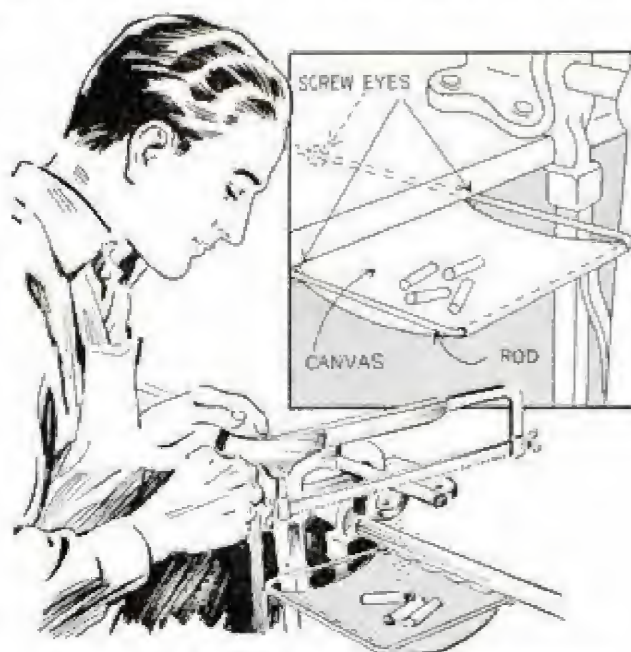
Screwed to a doorstep or porch floor, one of these amusing foot scrapers will serve as a reminder to clean shoes before entering your home. Cut from heavy sheet metal with a cold chisel or scroll saw, and the edges smoothed with a file, the scrapers are finished with a good weather-resisting paint

Canvas Drawer Catches Small Parts Dropped from Vise

When small parts are being cut off or assembled, in a bench vise, you can prevent them from dropping on the floor by means of a canvas drawer, which pulls out into position when needed. The front edge of the cloth is stitched to a U-shaped rod, which slides in and out beneath the bench through screw eyes, while the rear edge of the canvas is tacked to the underside of the workbench.

1937 INDEX

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When sawing off work or handling small parts clamped in a vise, use this canvas drawer to catch pieces dropped accidentally

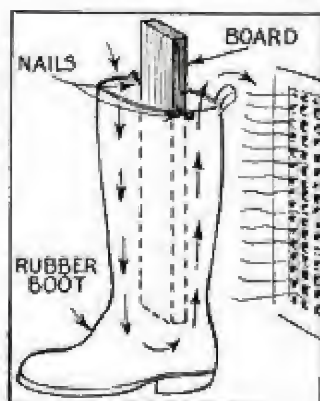
Gardener's "Check-Row Wire" Spaces Plants Evenly



Clothespins clipped to guide wire are quickly adjusted to space seed planting as desired

Home gardeners who want their vegetable rows planted uniformly, or want to space the plants for two-way cultivation with a wheel hoe, can do the job by clipping spring-type clothespins to their guide wires. The pins are merely spaced on the wire a distance equal to the desired spacing of the plants. When moving the wire for each new row, always change one end at a time, leaving the other end firmly anchored, and pull it to approximately the same tautness each time. A small coil spring tied to the end of the wire and to the stakes helps in gauging the tautness.

Board Slipped in Wet Boot Permits Quick Drying



When you get your rubber boots damp inside; they can be dried out quickly by inserting a thin board into each one, leaving 3 or 4 in. clearance between the lower edge of the board and the boot bottom. Set

the boots near a register or stove, or even outside in the sun so that one side will be warmed. Air between the warm side of

the rubber and the board will be heated slightly and will tend to rise, pulling in air from the cold side. This creates a draft that quickly dries out the wet fabric.

Hand Plane Protected on Bench

Instead of laying a plane down on your bench, while adjusting the work, tack a wood strip near the edge of the bench within easy reach and rest the nose of the plane on it.

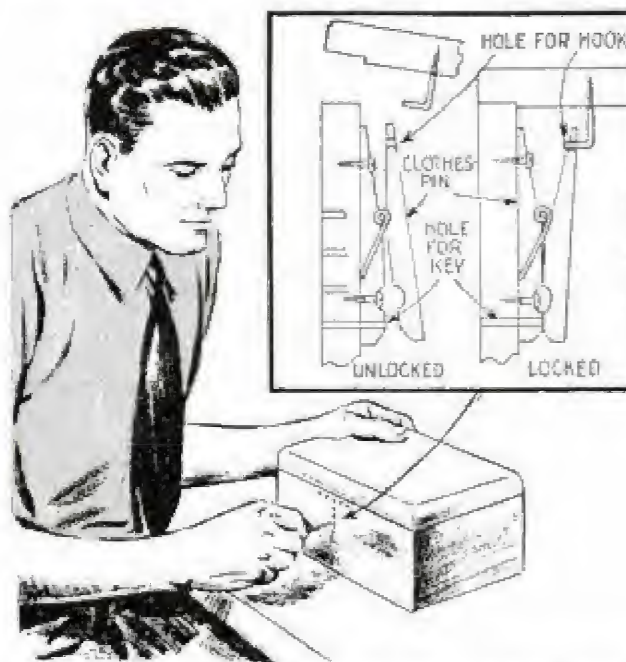


This prevents the edge of the plane iron from coming in contact with the bench surface, which might dull it.

—Raymond B. Wailes, Bethesda, Md.

This Secret Lock Is Opened with a Match Stem

Here's just the lock you have been wanting for that treasure box. It costs nothing because all you need is a spring-type clothespin, a match and an L-hook or screw. First drill a hole in one of the legs of the clothespin to take the hook. Screw the clothespin to the inner side of the front of the box and drive the hook into the underside of the lid so that the hook will



This simple lock costs nothing and it will keep the contents of box safe from prying eyes

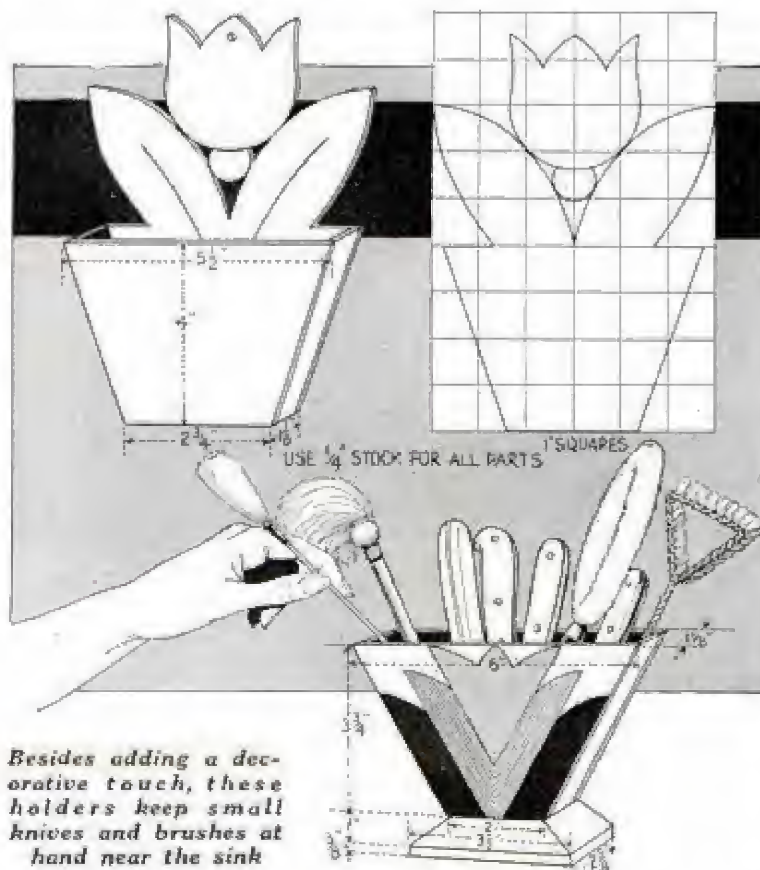
slip into the hole in the leg. Drill a hole through the front of the box and through the fixed jaw of the clothespin to take the match. Several false holes drilled part way through the front will add to the deception. To operate the lock, push the match through the hole against the movable jaw of the clothespin to compress the leg and release the hook, which will permit the lid to be raised.

—Robert M. Eadie, Granum, Alta., Can.

Vegetable Knives and Brushes Kept in Decorative Holders

Handy containers for kitchen cutlery to hang on the wall or stand on a shelf near the sink, are made easily of wood. The handles extend above the container so that the correct one can be picked at a glance. Such articles as vegetable brushes, pastry and bottle brushes, apple corers and dish mops are put in with the handles down, so that the brush or top part is exposed to the air to permit thorough drying. The hanging container is shaped like a flowerpot, the back extending above the front to form the plant, while the stand is made in the same manner, but has a sturdy base.

—B. Livings, Batavia, Ill.



Besides adding a decorative touch, these holders keep small knives and brushes at hand near the sink

Uniform Guide Lines for Lettering Assured with This Gauge



Correct spacing of lettering guide lines is assured when this simple gauge is used

On a job that required lettering of various heights, I used the gauge shown above in drawing the guide lines to assure that the lettering would be proportionately uniform in height. The gauge is a triangular piece of sheet brass, which has fourteen lines scribed exactly $\frac{1}{32}$ in. apart, small holes being drilled at the end of each line to take the point of a pencil. In use, the lower edge of the gauge is held carefully against a T-square, a pencil is inserted in one of the holes, and a guide line is drawn, moving the gauge along the square, which serves as a straightedge. The second line is drawn in the same way, inserting the pencil in the hole necessary to get the correct spacing for the lettering.—J. C. Garnett, Watford, Herts, England.

¶ When you put flour on steaks, fish or poultry before frying, mix seasoning with the flour, put it in a paper sack along with the meat and shake; you will find that every crevice in the meat is covered.

Narrow "PEG-LEG" COFFEE

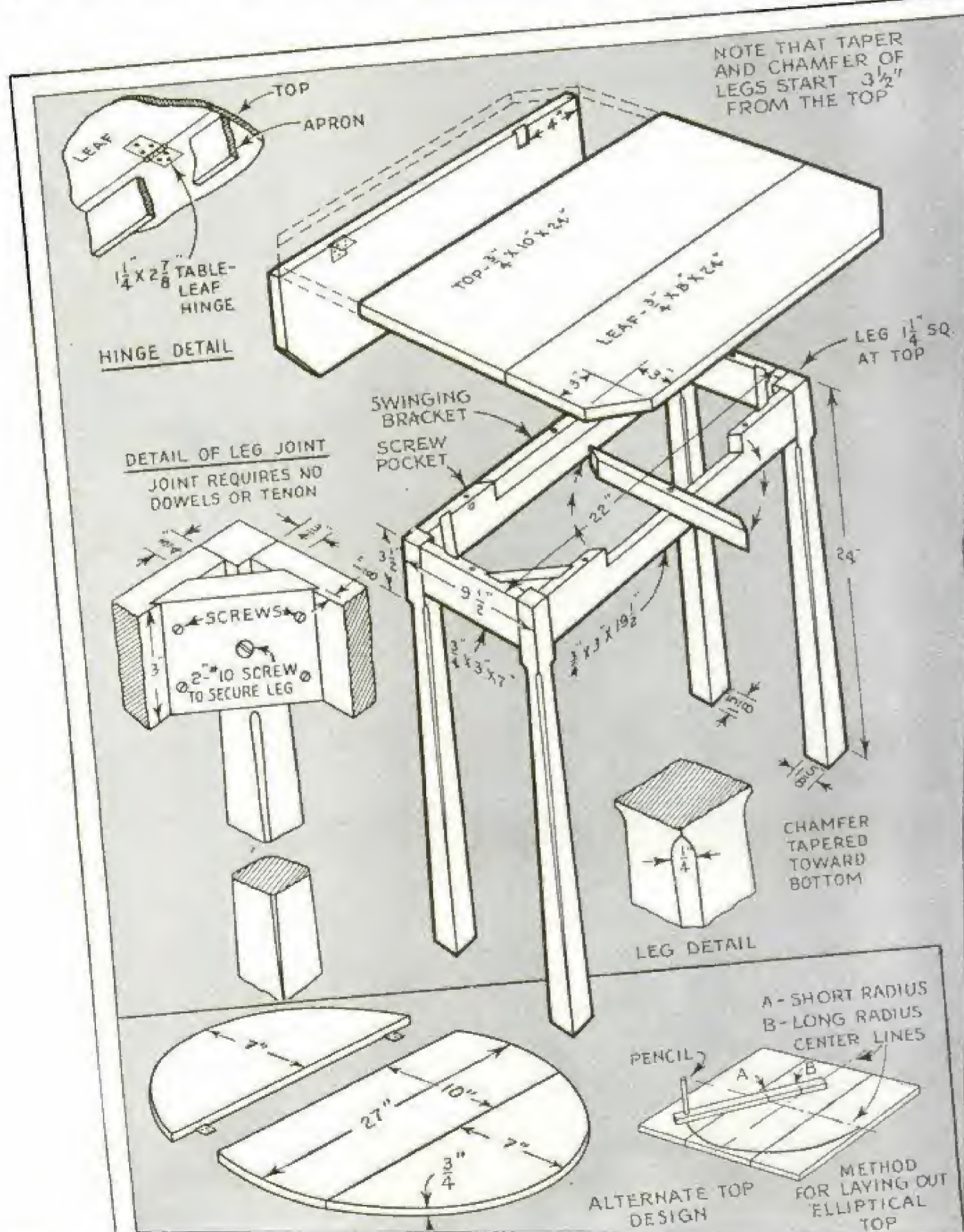
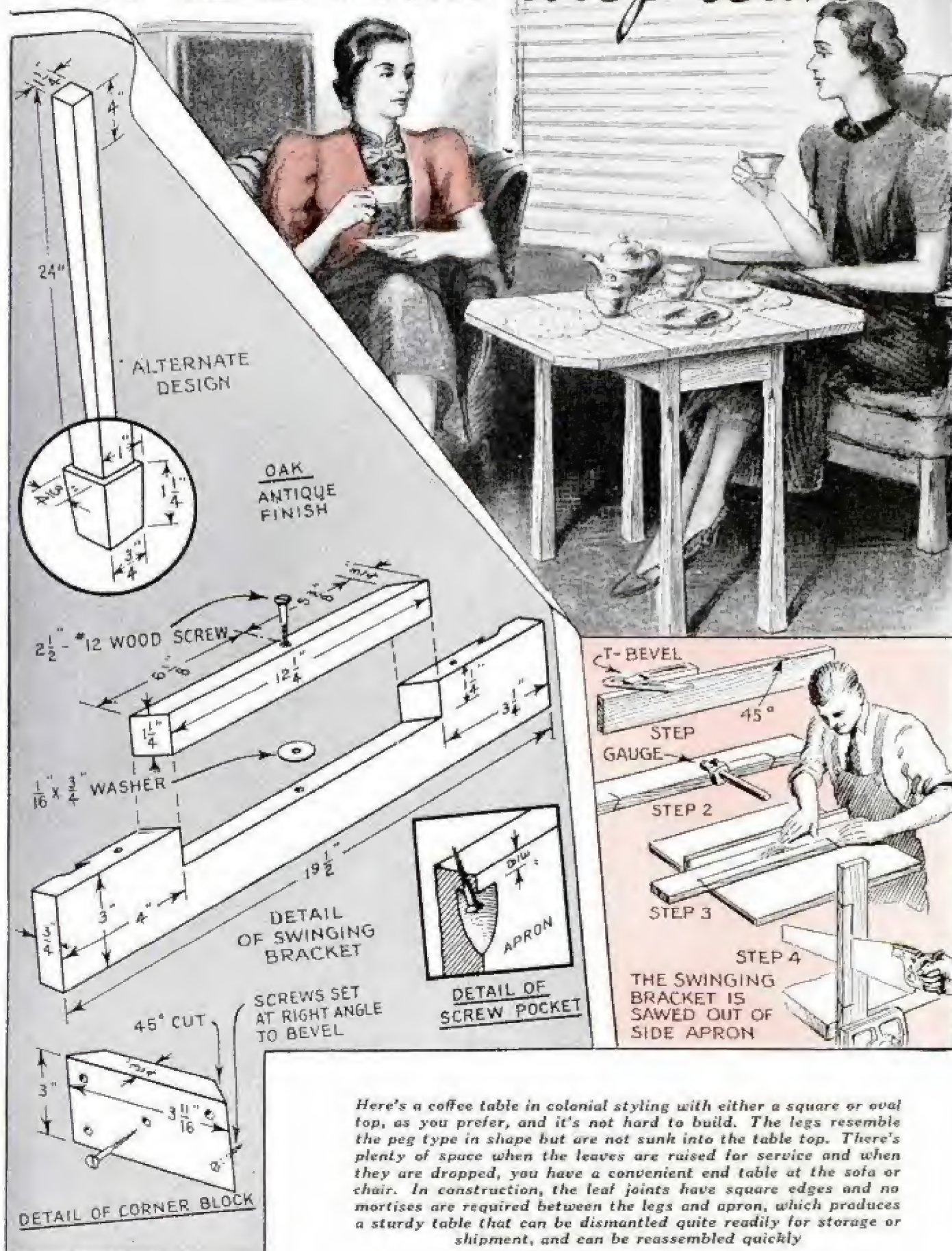


TABLE *has drop leaves*



Tape Loops on Drawing Board to Carry T-Square

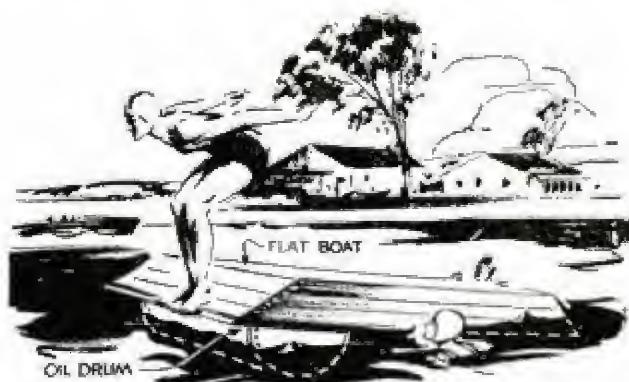


Loops of tape on underside of portable drawing board carry T-square without breakage

The problem of carrying a T-square with a portable drawing board is solved by sticking pieces of gummed-paper tape to the underside of the board as indicated. Just place the square in position, press the tape over it tightly and stick the ends to the board. The square can be slipped in or out of the paper loops easily.

Flat Boat Inverted over Oil Drum Provides Handy Diving Board

While vacationing at an inland lake where there was no diving board at hand, the members of a camping party inverted an old flat boat over an oil drum, which



Submerged end of boat makes it easy for swimmer to climb on this improvised diving board

was sealed tightly. The drum supported one end of the boat above water so it served nicely as a temporary diving board.

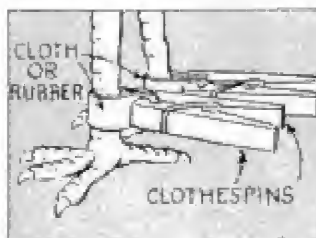
Creeping Weeds Pulled Easily with Aid of Shoehorn

For weeding in the garden between plants where a hoe cannot be used, and difficulty is encountered in pulling the creeping type of weeds with the bare fingers, a shoehorn is handy. It prevents sore fingers and enables you to do the work quickly.



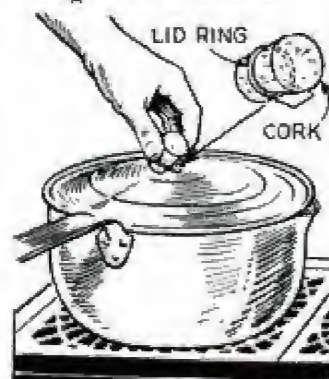
Hobbles of Clothespins Keep Hen from Scratching in Garden

When a hen with chickens is turned loose in the yard, she can be kept from scratching in flower beds with these simple hobbles. They are made by wrapping a piece of cloth or inner tube around each leg and clamping it in place with spring-type clothespins. When the hen attempts to scratch, the pins fly about and get in the way so that she is soon discouraged.



Cork Finger Grip on Potlid

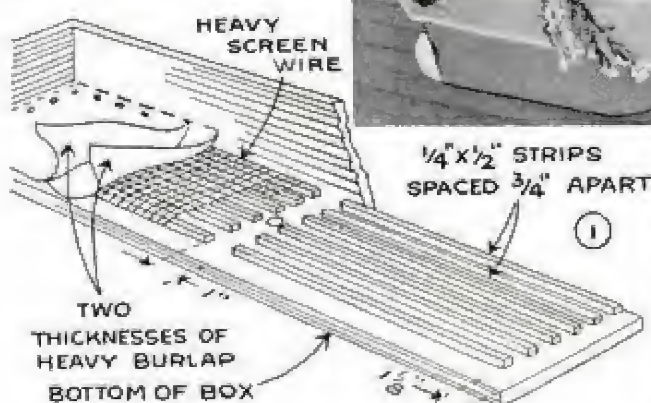
Campers who carry potlids having ring finger grips that fold down against the lid so that they pack closely, can use corks pushed into the rings to avoid burning the fingers. The corks should be a press fit in the rings so that they will stay in place.



It's time for WINDOW GARDENS

By Clarence Robert Stahler

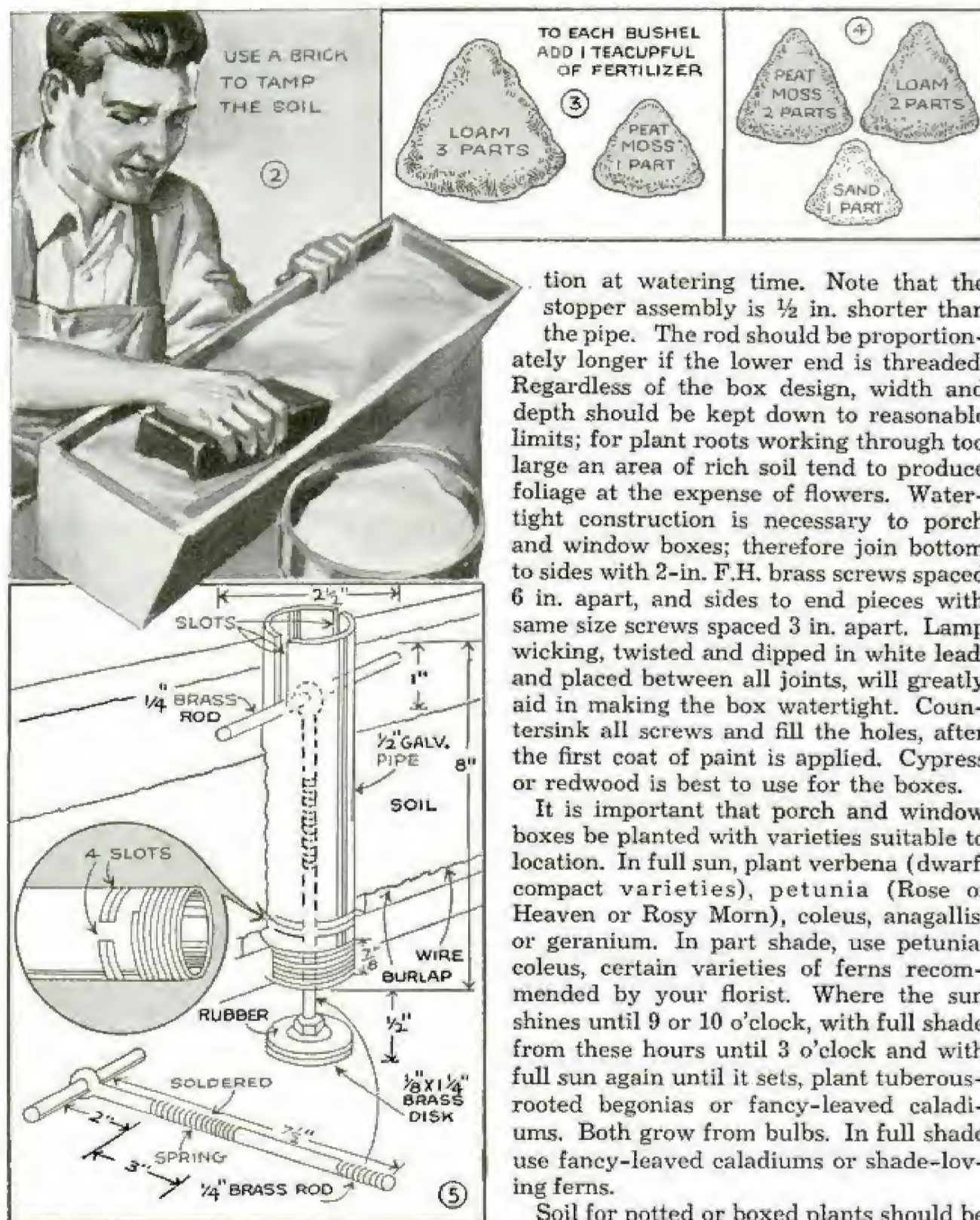
SUCCESS in growing plants in a window box comes from attention to a few simple details of box construction and plant culture. Growing conditions, the amount of sunlight, and the quality and friability of the soil used must be taken into careful account beforehand. Since the plants grown in the box will be confined closely, provision for perfect drainage is the first essential. Multiple holes bored in the bottom of the box and covered with pieces of broken crockery often fail in purpose. Some clogging is bound to occur; but even if this system functions, water, when applied, often immediately escapes. This is due to shrinkage of the soil mass when it becomes dry, leaving a well-defined crevice between the soil and the box walls. Water flows down the crevice and out the drainage holes without reaching the plant roots. Fig. 1 details a drainage system that overcomes these difficulties. After nailing strips to the bottom of the box, attach sides and end pieces. Then heavy screen wire (hardware cloth) is laid over the strips, and covered with two thicknesses of heavy burlap. Run the burlap a few inches up the box walls and tack it to



prevent soil sifting through at these points. Notice that a single $\frac{3}{4}$ -in. hole is drilled at the center of the 1-in. space between the ends of the cleats, Fig. 1. A plug

is fitted in this hole and allowed to project so that it can be inserted and removed readily.

With slight dimensional alterations, this drainage system can be adapted to boxes now in use, and to new ones of any size. However, if the box is to rest on a wide porch rail, or on a window ledge, the standpipe, Fig. 5, should be substituted for the wooden plug. To construct the standpipe, first cut the slots and vents, then file an opening at the threaded end so that the rubber gasket will fit snugly against it. Apply white lead and screw the threaded end into the $\frac{3}{4}$ -in. hole. To assemble the stopper within the pipe, solder together handle, brass rods and spring, Fig. 5. Drop



this assembly into the pipe and let the handle rest in the slots. Put the rubber gasket and brass disk in position and solder tip end of brass rod to the disk, or the rod may be threaded and two nuts used as shown. The spring must be sufficiently stiff to hold the gasket firmly against the pipe outlet when the handle is raised and is resting on top of pipe, which is its posi-

tion at watering time. Note that the stopper assembly is $\frac{1}{2}$ in. shorter than the pipe. The rod should be proportionately longer if the lower end is threaded. Regardless of the box design, width and depth should be kept down to reasonable limits; for plant roots working through too large an area of rich soil tend to produce foliage at the expense of flowers. Watertight construction is necessary to porch and window boxes; therefore join bottom to sides with 2-in. F.H. brass screws spaced 6 in. apart, and sides to end pieces with same size screws spaced 3 in. apart. Lamp wicking, twisted and dipped in white lead, and placed between all joints, will greatly aid in making the box watertight. Countersink all screws and fill the holes, after the first coat of paint is applied. Cypress or redwood is best to use for the boxes.

It is important that porch and window boxes be planted with varieties suitable to location. In full sun, plant verbena (dwarf, compact varieties), petunia (Rose of Heaven or Rosy Morn), coleus, anagallis, or geranium. In part shade, use petunia, coleus, certain varieties of ferns recommended by your florist. Where the sun shines until 9 or 10 o'clock, with full shade from these hours until 3 o'clock and with full sun again until it sets, plant tuberous-rooted begonias or fancy-leaved caladiums. Both grow from bulbs. In full shade use fancy-leaved caladiums or shade-loving ferns.

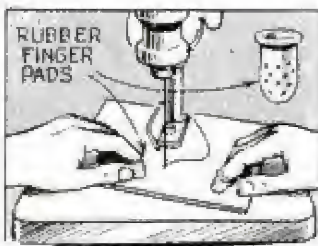
Soil for potted or boxed plants should be richer than that of the garden. For petunia, anagallis and coleus use the proportions given in Fig. 3. Measure peat moss dampened and packed. To each bushel of the mixture add a teacupful of fertilizer. For geraniums and verbenas reduce garden loam to 2 parts and replace the loss in bulk with clean sharp sand. Reduce fertilizer one-fourth. Begonia, caladium and ferns require a soil with a higher vegetable mat-

ter content: 2 parts peat moss, 2 parts garden loam, 1 part sand, Fig. 4. Add $1\frac{1}{4}$ cups of fertilizer per bushel.

When filling a box with soil, distribute it in 2-in. layers, firming each down with a brick as in Fig. 2. Fill to within an inch from the top, and then water thoroughly. When the soil is dry enough to handle, loosen the top 2 in. of soil and after firming down, add enough soil to bring it to proper height which is $\frac{3}{4}$ in. from the top of shallow boxes and 1 in. from the top of deeper ones.

If you buy plants from a florist, get them in pots. Obtain a bottle of nursery insecticide and mix a strong solution according to directions, for dipping purposes. To dip the plants, hold the pot with the thumb on its bottom and fore and middle fingers supporting the earth ball. Invert the plant and plunge up and down into the solution. Repeat three times, four days apart. Store the dipping solution in an airtight receptacle. During the dipping process, bed the plants up to the pot rims in wet peat moss, or in the garden, to prevent rapid drying out. Water when necessary. A daily watering is generally advisable, and always should be done during the morning hours. At watering time, close the drainage system and fill the $\frac{3}{4}$ or 1 in. of watering space. Never leave the drainage system plugged. After water has been absorbed, open up the system. Beginning about six weeks after the boxes are planted, additional plant food should be given every two or three weeks, using amount recommended by the makers. Avoid getting fertilizer on the foliage, and immediately water it in. Remove faded flowers, and never permit seed pods to form.

Finger Pads Aid in Jigsawing Thin Wood or Metal



When cutting small pieces of thin wood or metal on a jig saw, slip rubber finger pads over your index fingers. You'll be surprised how

easily you can manipulate the work as the pads tend to prevent your finger tips from slipping on the surface of the work.

Large Stones Are Broken Safely by Heating and Rapid Cooling



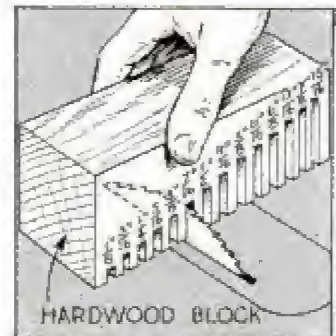
Large stone broken by heating it thoroughly and then throwing cold water over it

Desiring to break up and remove a large rock on his property without the use of dynamite, one home owner did the job by heating the rock and then dashing water over it. A trench was dug around the rock, and brush and wood were burned in it for a few hours to heat the rock. After the rock was heated thoroughly, cold water was suddenly thrown on it, which caused it to crack into several pieces.

Multiple Depth Gauge for Saw

If the circular saw in your workshop isn't provided with a scale for setting the depth of cut, this gauge will solve the problem and help assure accuracy. It consists of a hardwood block in which a number of cuts of various depths are made. The depth of each cut is stamped on the block so that you merely set the gauge over the saw and raise or lower it until the teeth touch the bottom of the desired cut.

—John R. Beckwith, Utica, N. Y.



Loaded Branches of Fruit Trees Supported on Adjustable Ropes



These adjustable support ropes are tightened easily as the weight of the fruit increases

Attachment of ropes to support heavily loaded limbs of fruit trees is simplified by these adjustable ropes. Each is provided with a stout hook at one end and a slotted stick at the other. In use, a rope is attached to the center of the tree by means of the hook, and the suspending end is drawn around a branch and fastened by looping through the notches in the stick. The device has another advantage in that it is instantly adjustable to the increasing weight of the ripening fruit.

Convenient Footrest for Oarsman

When a rowboat is used by persons of different heights, this footrest will be found a convenience as it can be adjusted



This footrest is instantly adjusted to suit rowers with either long or short legs

instantly to suit the length of each individual rower's legs. The rest consists of two notched wood strips which are nailed or screwed inside the boat as shown to take a length of broomstick.

Rows in Garden Are Marked by Seed Package

To indicate the location and variety of vegetables planted, one gardener uses "stakes" made of wire as shown. The double loop on top of the stake takes the empty seed package.



Needle Punches in Negative Indicate Exposure Time

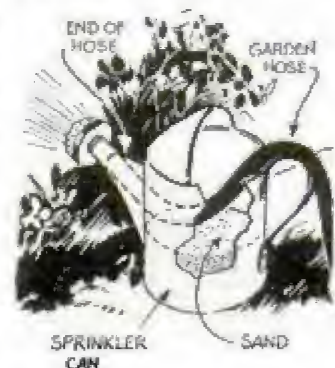


After printing a photo from a negative, punch holes along the edge of the latter with a pin or needle to indicate the exposure time. When you want to make reprints later, the holes in the nega-

tive can be counted in the dark by passing the tip of the finger over them.

Emergency Hose Nozzle

When you need a spray nozzle for a garden hose, and none is at hand, a sprinkler can will do the job. Partly fill the can with sand to keep it from upsetting. Then insert the end of the hose

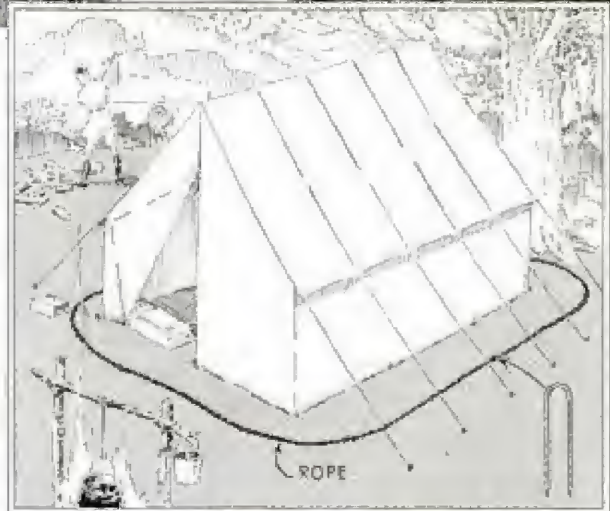


into the spout as indicated by the dotted lines. If the hose has a tendency to work out of the spout, weight it inside the can with bricks or stones.

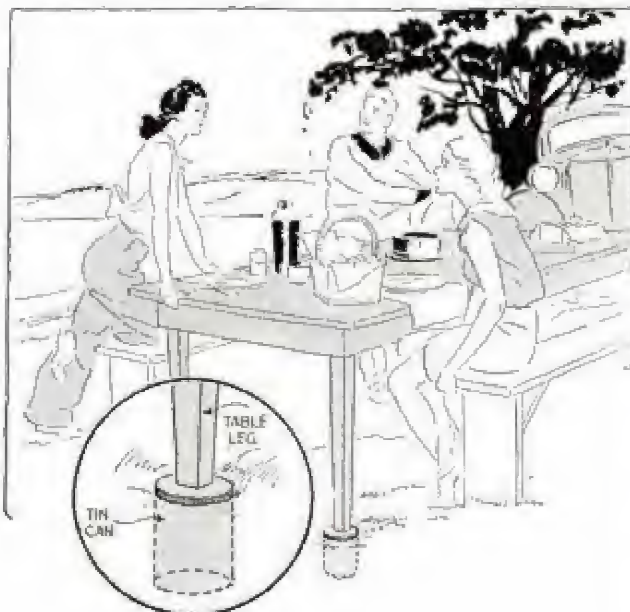
Two Helpful Ideas for Your Camping Trip



In order to travel as lightly as possible, hunters and campers going by canoe in northern Canada do not carry tent poles, but cut them at the camp site, using five, which are erected as shown above. Guy ropes at front and rear tend to brace the tent rigidly against a wind blowing toward either end. A creosoted rope laid on the ground around a tent as shown at the right will help keep away crawling insects. It can be fastened down with staples, which are bent from wire. These should be 5 or 6 in. long.



Legs of Picnic Table Are Supported on Inverted Tin Cans



The tendency of picnic table legs to sink into soft ground can be avoided by setting them on tin cans inverted and sunk into the ground. This also prevents the ends of the legs from rotting due to constant contact with moist earth. Lawn chairs and benches can be supported in the same way.

Printing Photos on Glossy Paper

Glossy paper may be handled in several ways to produce prints having various surface effects. A soft, semi-gloss is obtained by drying the prints between blotters. Other surfaces may be had by squeegeeing the emulsion side in contact with various textiles such as silk or linen, and then drying in the usual way.

EXTRA ROOMS



By R. O. BUCK

BY LINING the attic with insulating board you really "kill two birds with one stone," providing usable space and insulating that part of your house which requires it most for year around protection from extremes of temperature. In many cases savings in fuel alone, over a period of years, pay for the attic improvement.

Each house presents individual problems which should be well considered before planning an attic room. The type of roof, location of dormers, windows, stairway and chimney all must be reckoned with. In general, if your attic has enough windows for good ventilation in moderate weather, a practical stairway from the floor below, Fig. 1, sufficient area in which there is 7 ft. or more of height available and is either floored over or has 2 by 6-in. joists or larger, it may be considered suitable for improving.

Ventilation: While insulation goes a long way in the matter of keeping the attic cool in summer, moving air is necessary for real comfort. Sufficient windows, lo-

cated so that cross ventilation is possible, will generally keep the attic rooms comfortable. However, in warmer climates and in extremely hot weather, forced ventilation may have to be resorted to. An exhaust fan, located so that the blanket of hot air in the attic will be drawn off and replaced by cooler air from outside, is a solution of this problem. The floor below also may be cooled with the same equipment by simply closing the intake window in the attic and drawing all of the air from below through the stairway or by means of floor registers. A convenient portable unit which requires no building alterations is also available. It consists of a fan mounted on an adjustable stand, a canvas tube, window board and louver. It is only necessary to fit the board to the window opening when the sash is raised. The unit may be removed at will. A permanent installation usually makes a neater and more satisfactory arrangement if the fan is to be used most of the year. The fan unit in this case is suspended in a spring frame on

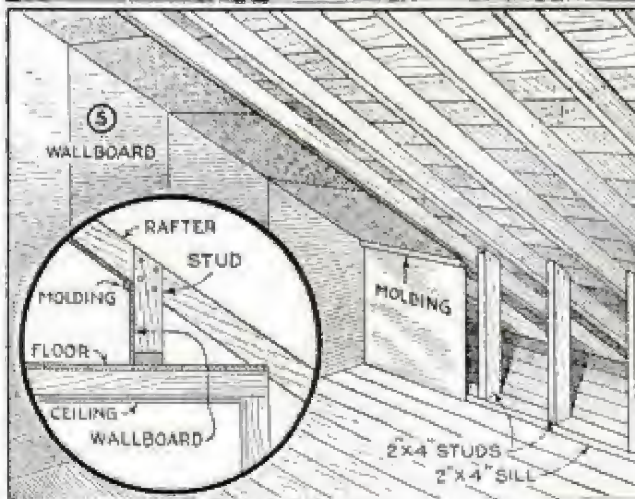
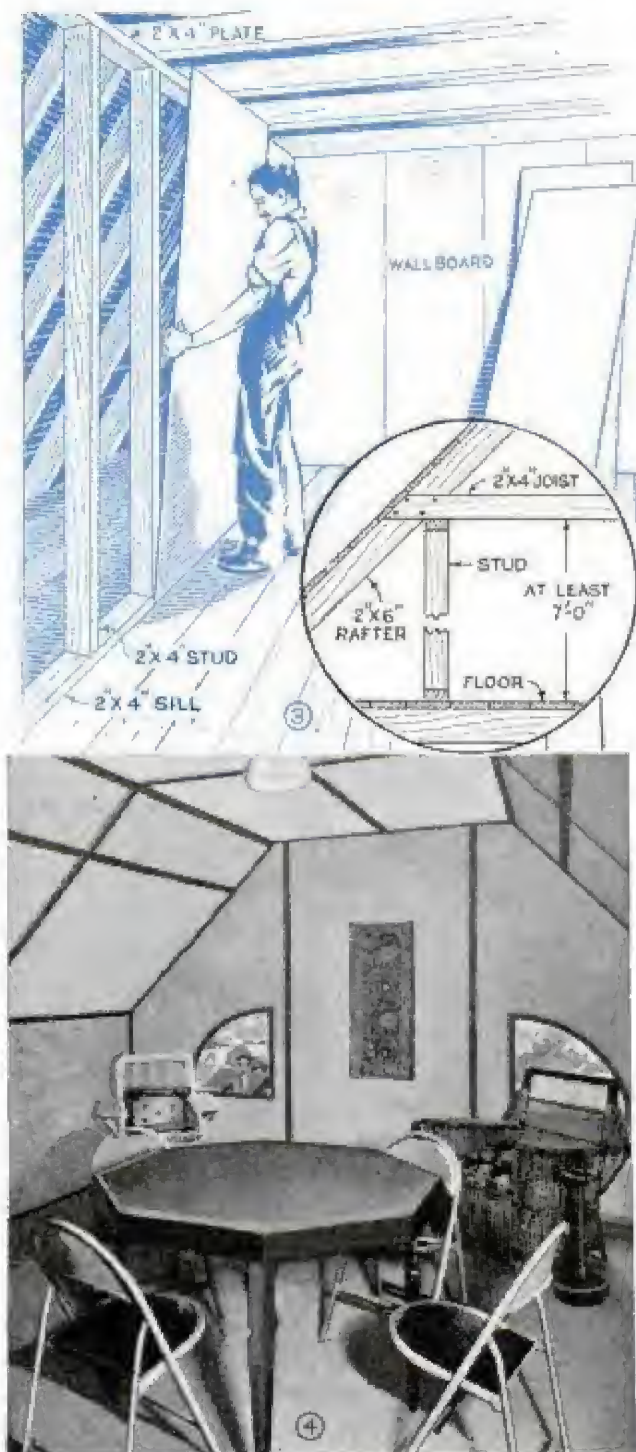
in the ATTIC



the inside of the wall over a suitable opening. The springs absorb any noise or vibration from the motor. If the fan is installed in the finished part of the attic, it may be concealed by means of a grill, lattice or case having a perforated door. The outside opening must be arranged so that rain or snow will not enter. A simple wood louver, such as can be obtained from millwork companies, provided with an inside door for winter use, may be used satisfactorily. A newer and more convenient device is the automatic shutter which opens when the fan is running and closes when it is shut off.

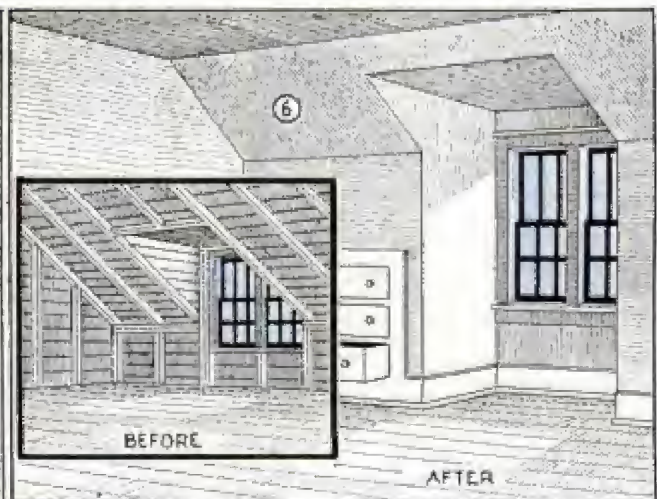
Heating: Heating the attic room must be considered also if you are to have the fullest enjoyment from it. In the case of a bedroom, where only a moderate amount of heat is required, one or two floor registers will bring sufficient heat from the floor below. Added ducts for hot-air registers or a continuation of present ones is also possible. Steam or hot-water pipes also may be run up and radiators installed in the usual way if the expansion tank on the latter is placed high enough. Should





none of these suggestions prove practical, a gas-steam radiator or a fireplace containing a radiant unit will provide the necessary heat. A flue to the chimney or the outside is advisable with any gas appliance, however.

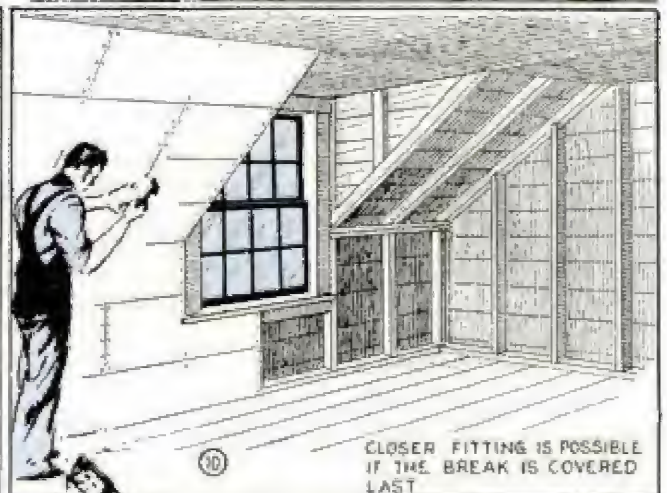
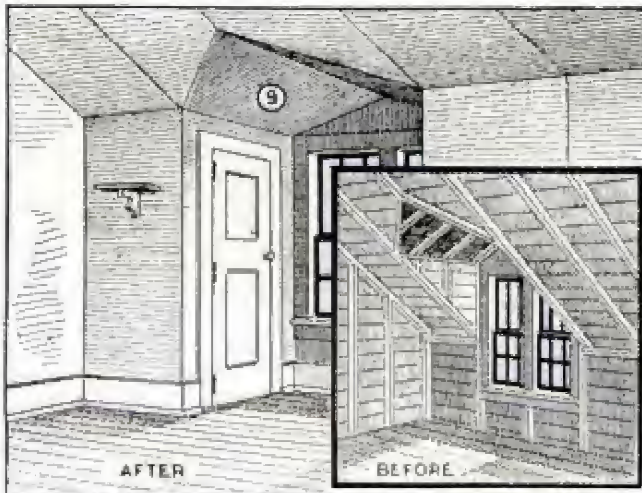
Framing: If sufficient space is available in all or any part of your attic room, full height side walls and horizontal ceiling are preferable in most cases. The ceiling should be at least 7 ft. high, both for appearance and ventilation. The framing of the side walls should be done first. The sills and plates are laid out on the floor and the studs spaced along them, 16 in. on centers in the usual way, and nailed. Provision for door openings, built-in cases, etc., should be made in the stud openings. Both side frames are then raised into position, as shown in the detail in Fig. 3, and nailed to the floor and rafters. If the plaster on the ceiling below is poor or the floor unusually springy, screwing the sills to the floor may be advisable. Care must be taken also not to wedge the frame under the rafters too tightly as this may spring the floor joist and result in damaged plaster below. The 2 by 4-in. ceiling joist are laid across the top of the plates, toenailed to them and spiked to the sides of the rafters. Where the ceiling must follow the line of the roof for part of the height, as shown in Figs. 2 and 4, short studs are spiked directly to the sides of the rafters where the wall is to join the sloping ceiling, Fig. 5. If any part of the ceiling is to be horizontal, joists are simply nailed between opposite rafters. The joint between the slant and vertical or horizontal surfaces would leave the edges of the insulating boards unsupported, so strips of



1-in. material, to form grounds, must be nailed between the rafters, studs and joist at these points.

For some types of rooms exposed rafters produce a very pleasing effect. Ornamental "false rafters" can be used for a purely decorative effect after the walls and ceiling have been covered with insulating board. In many cases the real rafters may be left exposed.

Wall Coverings: A great variety of materials is available for finishing interior walls. Where the ceiling and outside walls are to be covered, boards having insulation value are essential. Most of the so-called softboard, including plaster board, is suitable for this purpose. These materials come in a number of standard sizes, thicknesses and textures but all are intended for use on studs, joists or furring spaced 16 in. on centers, and should be nailed all around, the nails spaced 4 to 6 in. apart. For finishing around dormers, such as shown in Figs. 6, 8, 9 and 10, where considerable fitting is necessary, large size boards will be found most convenient because of the fewer cuts necessary. The cutting and fitting of this material is very simple, the space is simply measured carefully, the cuts laid out on the board with a square and pencil, as shown in Fig. 7 and the material sawed to size. Several types of joints between boards are possible. When the board is to be left unfinished simple lattice strips nailed over the joints make a satisfactory solution, Fig. 4. A newer and more finished appearance can be obtained either by the use of boards having a beveled edge to produce a V groove at each joint or by the use of molding strips made of the same material as the





board, which are available in a variety of patterns and sizes. The room shown in Fig. 8 gives an idea of the beautiful finished effects which may be obtained by the use of molding strips. If the wall is to be papered or canvased, tight joints are necessary. To secure tight joints the edges of the boards must be beveled, as in Fig. 11, then butted together and the joints filled with a special putty. Metal tape or screen wire is next laid over the putty and the material pressed through the tape with a putty knife, then feathered off smooth. Sanding after the putty is dry is also advisable. The steps are shown in Figs. 11 to 14 inclusive.

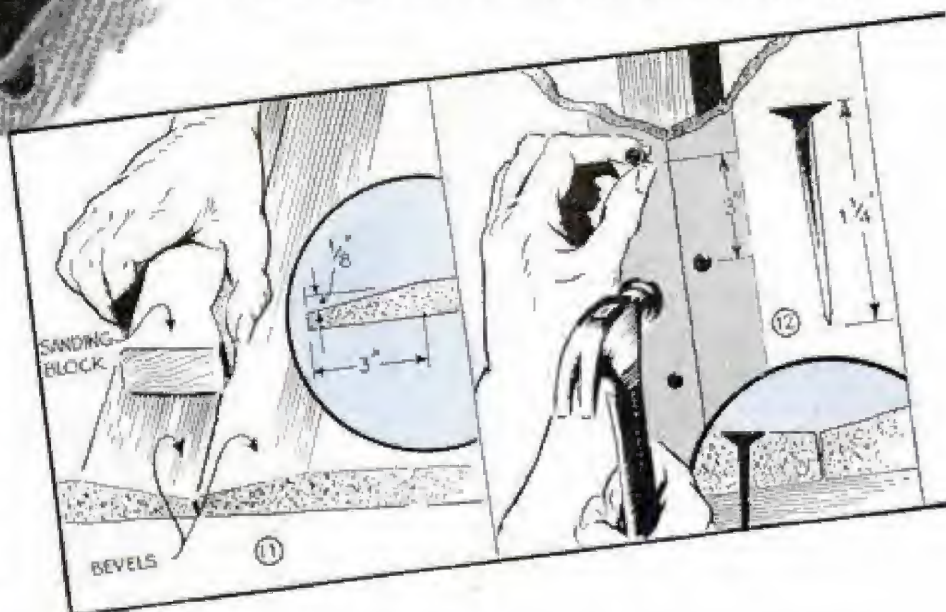
A new plaster board finished in several remarkably realistic wood grains is available and makes an exceptionally beautiful wall.

When finishing a sloping ceiling, such as shown in Fig. 10, it is advisable to board up from below and down from the ceiling leaving the part near the break to be fitted in last, as in this way a closer joint is possible, especially if the piece is narrow.

Some Possibilities: Waste space around a dormer generally can be utilized for built-in bookcases, closets, or a chest of drawers, as in Figs. 6, 8 and 9.

If you wish to give your attic space individuality so that it will not be just another room, you must decide what purpose the room is intended to serve, then plan points of interest utilizing the various peculiarities of the space to best advantage. Planning a boy's room offers a splendid opportunity, especially where the available space is limited and the roof rather low. Often you can achieve a very attractive and unusual arrangement by a judicious placing of a bunk over the stair well.

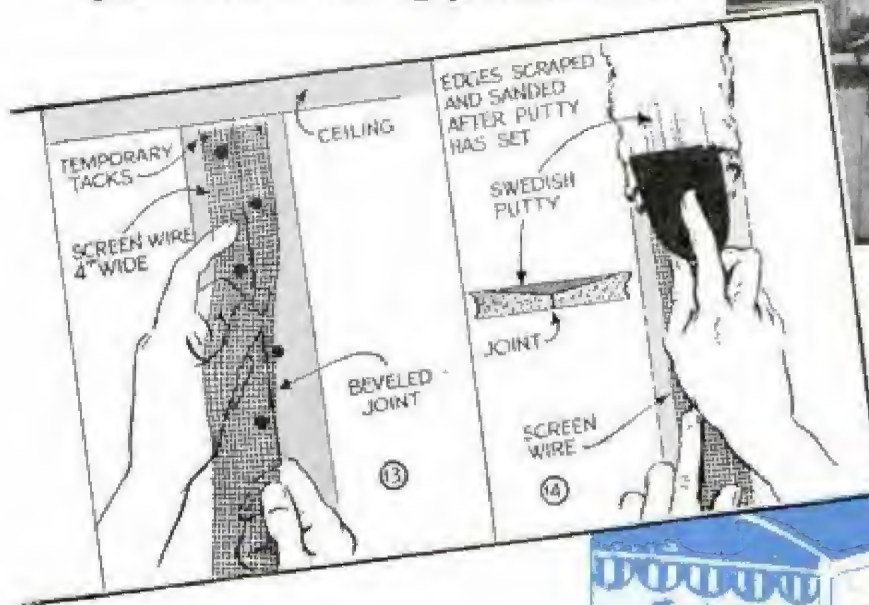
Beamed ceilings are nearly always effective as they give the maximum of head-room together with good ventilation, an



essential if the space is to be used as a den or smoking room. A bedroom or boy's room always gives opportunity to utilize space in a complete and attractive manner. Wall decorations and built-in chests and bunks are generally features of such rooms and in the average attic you'll find plenty of space to build them in. For a real "sporty" type of game room the Old English Taproom styling with knotty pine walls works out nicely. Knotty white-pine shelving and the matching wall material are comparatively inexpensive and when finished in a smoky-brown color are particularly appropriate. A music room is another possibility. The sloping ceiling gives good acoustics without echoes, and the softboard wall absorbs sound so that you may enjoy music without disturbing the neighborhood.

However, before putting heavy pieces of furniture, such as large billiard tables,

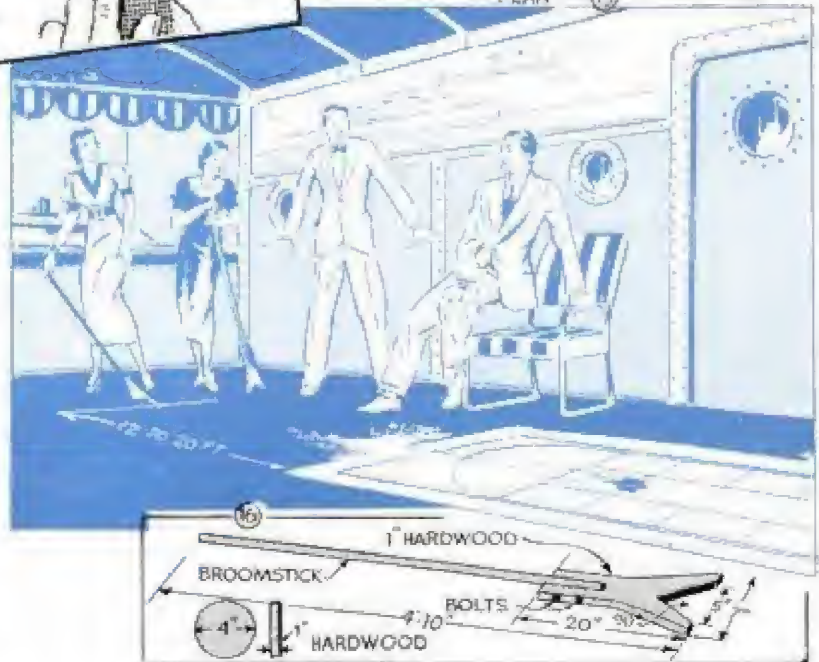
pianos, etc., into an attic room, make sure that the floor is sufficiently rigid to bear the weight without springing the joist. A sagging floor is almost sure to crack the ceiling plaster below. Determine the size of the floor joist by measuring the facing board at the stairway, as in Fig. 1. Facing boards 7 or 8 in. wide indicate a 2 by 6-in. joist while a 9 or 10-in. board shows that 2 by 8-in. joists have been used. The former are too light for heavy objects unless they are placed over a bearing partition which



will carry the weight down to the center supporting timber or I-beam in the basement.

Painting games on the floor or inlaying various colored pieces of linoleum into a floor size piece by cutting through the two thicknesses is an excellent scheme both from the utilitarian and decorative viewpoint. The popular deck game of shuffleboard may be enjoyed in your attic recreation room quite as well as on an ocean liner, as shown in Figs. 15 and 16. The cues and disks, the dimensions for which are given in Fig. 16, are easily made and the layout for the floor lines can be obtained from Fig. 15.

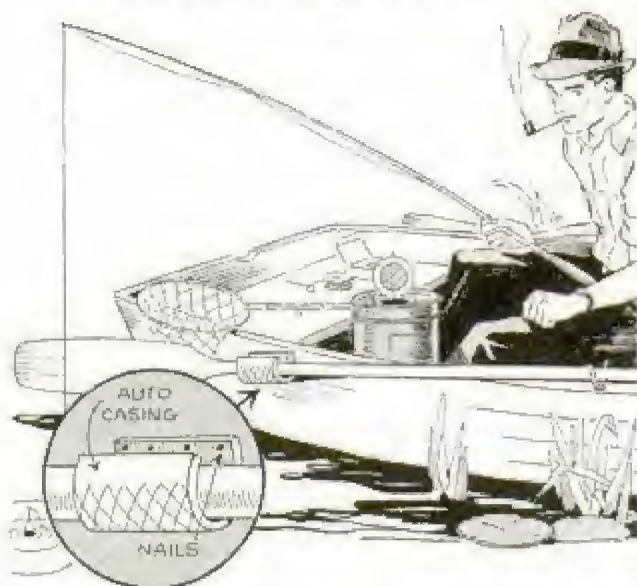
The object of shuffleboard is to shove the disk from the starting line to within the numbered spaces, at the same time attempting to knock opposing disks out of the way. The cues are used to shoot the disks, which must go beyond the dead line or they are taken out of play. Players al-



ternate and score according to the numbers on which their disks come to rest after all have been played (four for each player). Plus and minus figures alter the score. Fifty points is game.

A checkerboard of "heroic" size is also a source of great amusement. The board is painted or inlaid in the usual form, making the square 6 in. or more in size. Large wooden disks are used for checkers.

Rubber Holders Support Oars While Fishing from Boat



Oars are kept out of the way, and they do not drip water into the boat when rubber holders are used

Tired of resting his oars on the boat in front of him and having them drip water over his tackle while fishing, one sportsman nailed rubber holders to the sides of his boat to support the oars as indicated. The holders were short pieces of an old auto casing with the beads cut off.

—Bob Poulson, Los Angeles, Calif.

Picnic Luncheon Cloth Is Held by Clothespins in Ground

The next time you go on a picnic, sharpen five or six regular clothespins and take them along. They are ideal for anchoring



Clothespins slipped over corners of picnic cloth and pushed into ground protect it against wind

the corners of the luncheon cloth to the ground to keep wind from blowing it about. Just twist each corner of the cloth, insert it between the legs of a clothespin and push it into the ground at an angle as indicated in the circular detail.

Feet of Adhesive Tape Protect Bottoms of Glass Graduates

To avoid accidental breakage of glass graduates on the stone tops of laboratory tables, attach short pieces of adhesive tape to the feet as shown. These pieces also tend to prevent slipping.



Keeping Slide-Rule Case Closed



Students, engineers and others who carry a slide rule in a case can keep it closed by wrapping a strip of adhesive tape around the flap as indicated. A single thickness of

tape is sufficient and allows the case to be opened easily with the fingers.

—Warren H. Buell, San Jose, Calif.

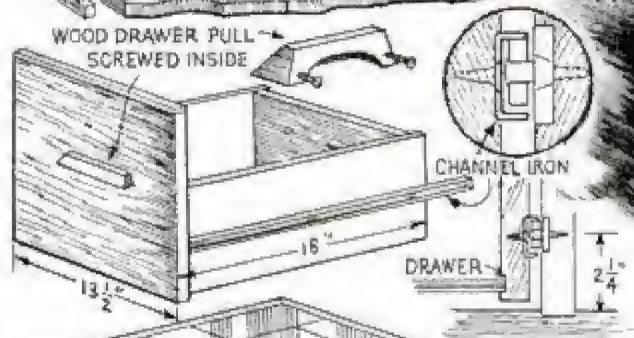
Handkerchief Keeps Its Shape in Coat Pocket

When you wear a handkerchief in your coat pocket, shape it as you like it. Then fold a piece of light cardboard over the lower part and slip on a rubber band. The cardboard holds the handkerchief in shape and is unnoticeable.

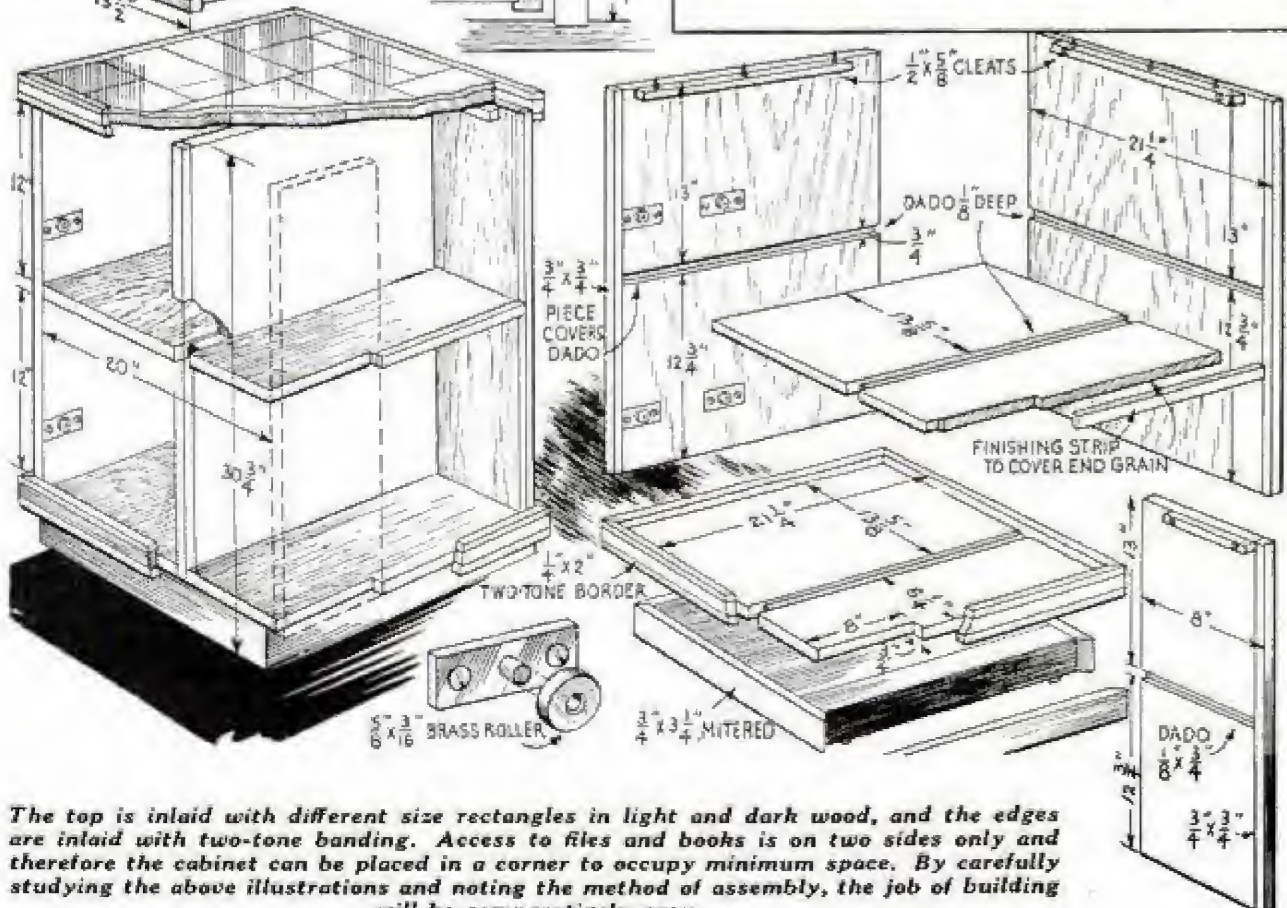


Combination BOOKCASE-TABLE

contains Filing Cabinet

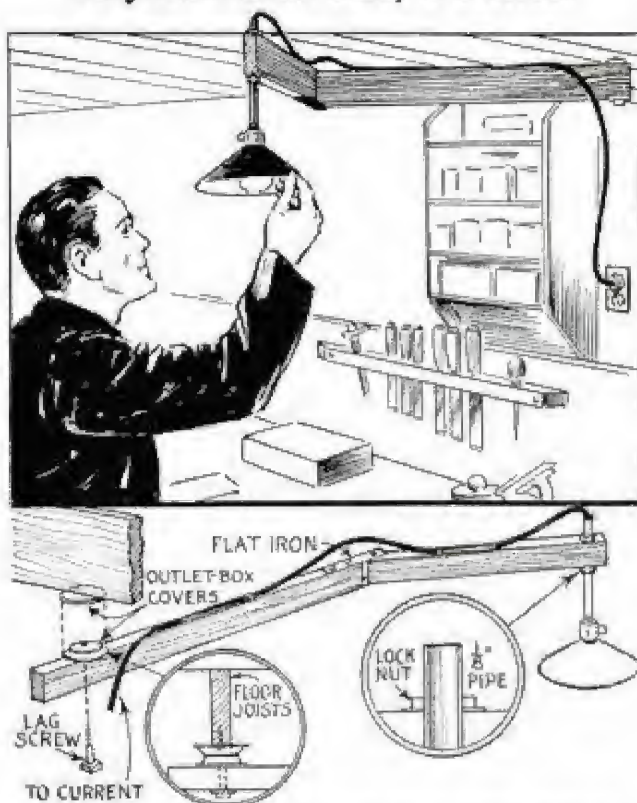


Your personal stationery and correspondence can be kept conveniently at hand in the den or living room if you have this combination piece of furniture, which fits in well with the style and furnishings of nearly any room. Besides the two drawers designed to accommodate the standard size of letterheads, there's ample space for a number of books



The top is inlaid with different size rectangles in light and dark wood, and the edges are inlaid with two-tone banding. Access to files and books is on two sides only and therefore the cabinet can be placed in a corner to occupy minimum space. By carefully studying the above illustrations and noting the method of assembly, the job of building will be comparatively easy

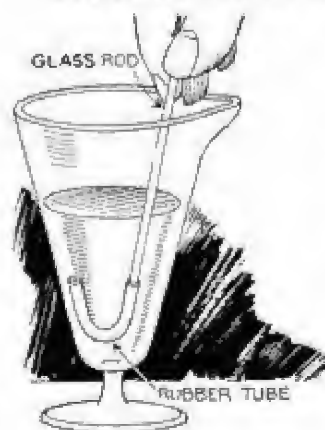
Non-Sag Lamp for Workbench Adjustable to Any Position



The pivoted arrangement of the support arm of this lamp prevents sagging

Pivoted on two electrical outlet-box covers, the arms of this adjustable workbench light can be swung to illuminate any part of the bench without sagging. The two covers, one screwed to the overhead floor joist and the other to the extending arm, are held together with a lag screw through the center. Proper adjustment of the screw to get easy movement of the arm is found by experiment. The circular detail on the right shows how the socket is fastened to the arm with $\frac{1}{8}$ -in. pipe and lock nuts.

Rubber Hose on Stirring Rod

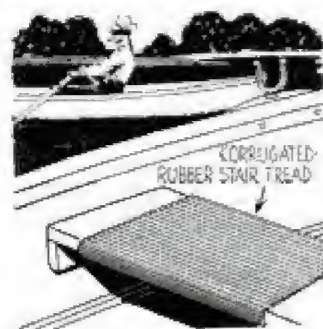


To aid in dissolving powdered chemicals in liquid solutions contained in a glass graduate, slip a piece of small rubber hose over the end of the stirring rod. The hose will bend to conform to the shape of the

graduate so that the wet powder that tends to stick to the glass is scraped off easily and mixed with the liquid. Small hose that has a ribbed surface is best as the corrugations of the rubber produce a good scraping action against the glass.

Non-Slip Covering for Boat Seat

To help avoid slipping off the seat, when pulling on the oars of a heavy boat, one fisherman employs a rubber stair tread. The curved edge of the tread engages the back edge of the seat so it will not slide forward under the movement of the boatman.



This Portable Sewing Nook Sets Any Place in Home

Any part of your home can be converted into a sewing nook with this folding screen, the back of which is equipped with pockets and shelves to accommodate sewing materials. When not in use, the screen can be folded and set away. One panel is

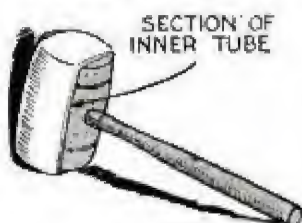


Folding screen holds all your sewing materials and is stored in closet when not in use

provided with small hooks at the top for hanging up unfinished garments, sewing apron or smock, yardsticks, etc. The center panel is equipped with three or more pockets sewed onto a strip of oilcloth or

cotton. The outside panel has narrow spool shelves near the top. Below this is a series of pockets to take care of the smaller articles needed in sewing. In the center is a deep pocket for scissors, on either side are shallow pockets to hold such articles as tape measure, thimble, cards of fasteners, needlebooks and other miscellaneous items. A square pincushion, flat at the back, is hung at one side on a drapery hook. At the bottom of the panel, a large paper bag serves as a wastebasket. Holes punched at one side slip over small hooks on the panel, so that the bag can be removed for emptying.

Emergency Soft Nose for Mallet



When using a mallet and the work requires a soft nose, just stretch a wide band cut from an inner tube over the head. The width of the band should be slightly less than the diameter of the head.

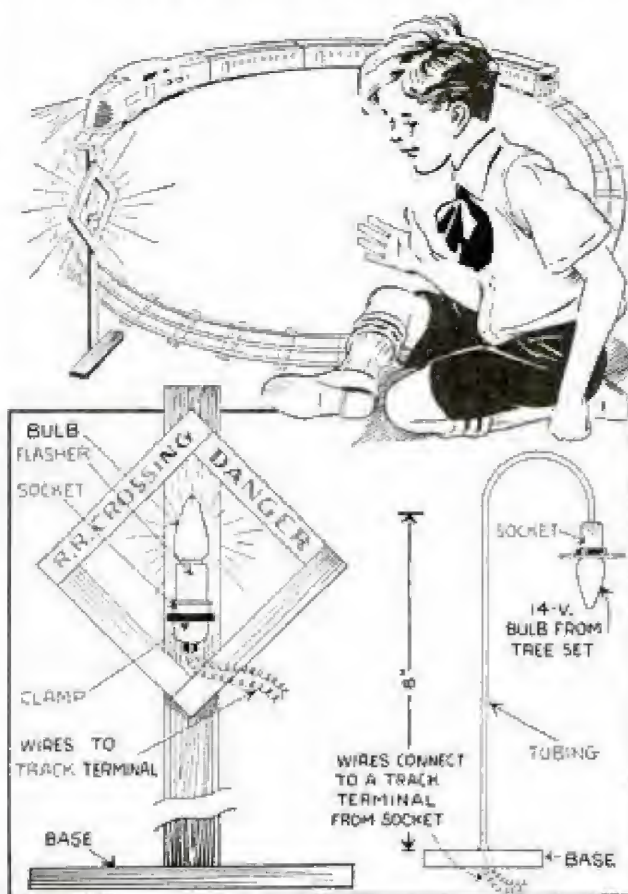
Simple Miter Box for Workshop from Two Pieces of Wood

A simple miter box that will handle most of the requirements of the home workshop may be improvised from two lengths of 2 by 4-in. stock, which are cut and bolted together as shown. In use, the improvised miter is adjusted to the desired angle and then clamped in a vise to hold it.



A scale marked off in degrees on the edge of the vertical piece improves the miter box

Christmas-Tree Lamps Illuminate Model-Railroad Signals



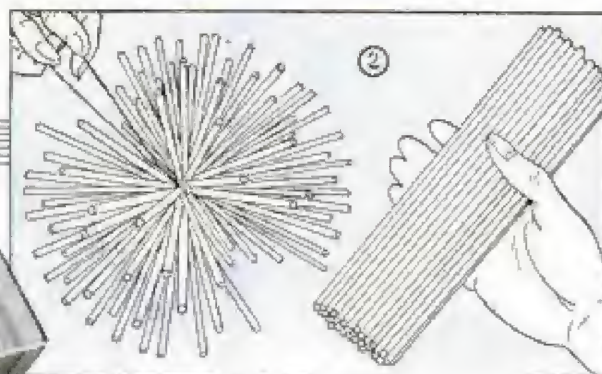
You can assemble inexpensive signals for a model railroad by using Christmas-tree lamps

You can assemble model-railroad signals from Christmas-tree lamps, two of which are shown. The flashing danger signal at the left is made of light wood and a lamp and socket are clamped to it and wired to the track, a flasher that is used on the tree lights being installed in the circuit to flash the lamp. The station lamp at the right is a length of small copper tubing soldered to a base and fastened to a socket and lamp, the wires being run through the tubing to the lamp. Many other types of realistic-looking signals can be made in a similar manner. As most lamps used on Christmas trees work on 14-volt current, you can use the regular train transformer to operate the signals.

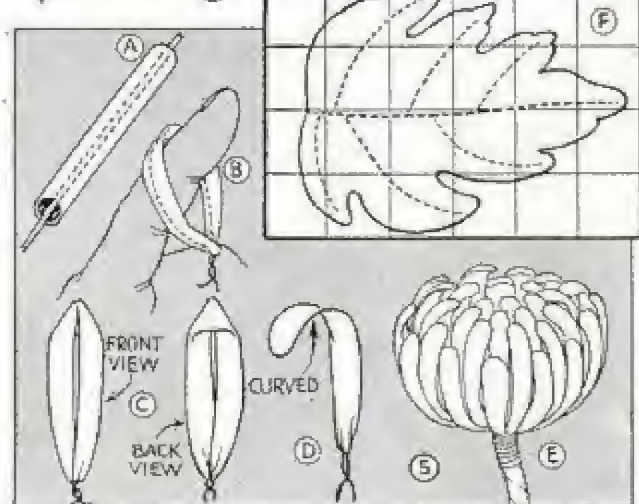
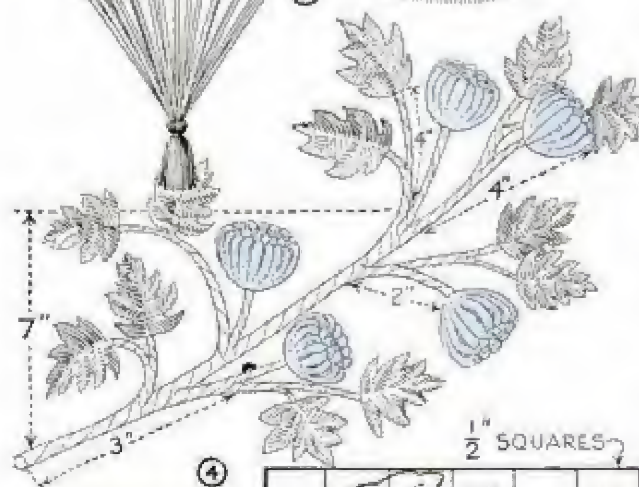
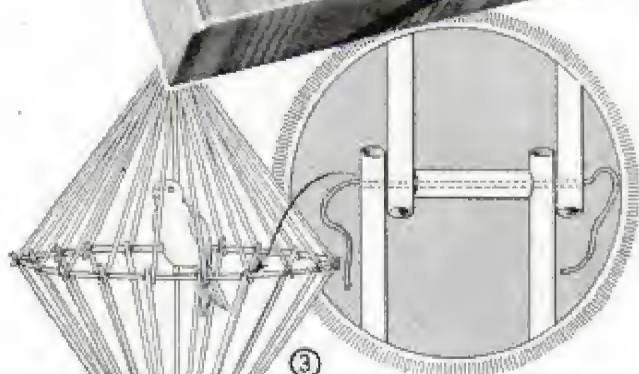
—William Naken, Chicago.

☞ A good way to handle cloths when giving a patient hot applications is to put the cloth in a potato ricer, dip it into the hot water and then wring out the water by pressing down on the cloth while it is still in the ricer.

NOVELTIES



By FLOYD MIX



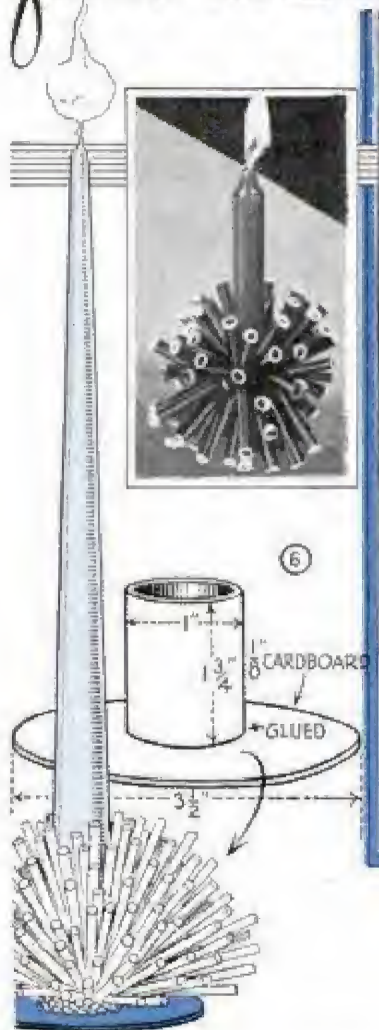
TRANSSPARENT Cellophane straws, available at most drug and ten-cent stores, find many uses in craftwork. To get the knack of using them, it's best to start with a simple project such as the gift-package decoration, or pompon, Fig. 1. In making this you will need a package of straws of a color and shade to harmonize with the package wrapping, and a 12-in. length of No. 32 spool wire, or stout cord. Place twenty to thirty of the straws together, and bind them tightly in the exact center as in Fig. 2. Pulling the wire up snugly will cause the straws to spray.

Only a slight variation of this procedure is required in making the candleholders shown in Figs. 6 and 7. For the small holder cut the straws about 4 in. long, tie them in place around the base of the candle and spread them out. For the large holder, construct a cardboard form as shown, coat it with colored sealing wax, then tie the straws together in bunches of four, and fasten several of these bunches around the candle form. The ends of the straws may be tipped with sealing wax of a contrasting color, before assembly, if desired.

The novelty cage for a yarn or celluloid bird, Fig. 3, adds a cheery note of decoration to a nursery or sun parlor. Sixty full-length straws are required. Cut four straws into 1-in. lengths to serve as spacers, then string them on yarn, as shown in the detail.

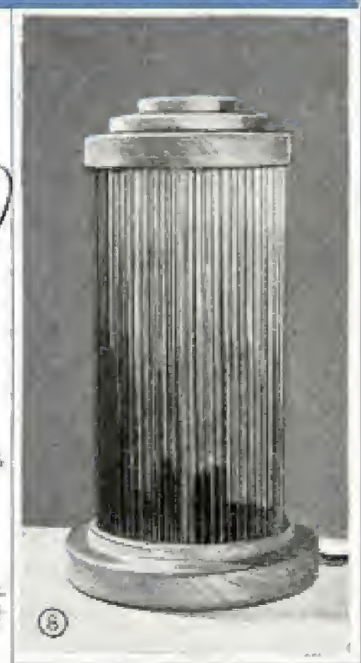
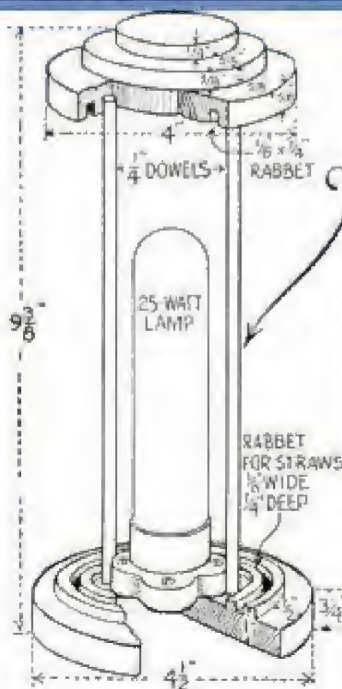
Fig. 4 illustrates a striking chrysanthemum table decoration, consisting of five flowers and twelve leaves joined together on a main stem. For each flower you will

from CELLOPHANE STRAWS



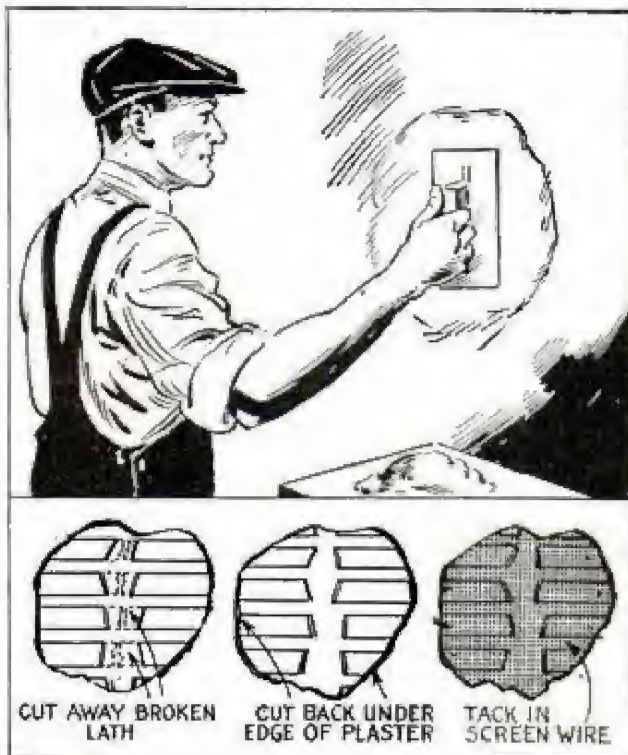
need twenty-six yellow straws 3 in. long and eight orange straws of the same length. Fig. 5, details A to E inclusive, gives the procedure to follow.

A 6-in. length of light wire is slipped into each one of the straws and they are flattened. Then they are bent to form petals. The ends of the fine wire are bound to a piece of No. 10 wire approximately 6 in. long, which serves as a stem. Leaves are made from pieces of kraft paper cut to the size laid out in the 1/2-in. squares. Two pieces of paper are required for each leaf. These are glued together, with a 6-in. length of light wire in between which serves as a stem. The surface of the paper is coated with green wax, and veins marked in the wax with a sharp object, while it is still warm. The leaf and flower stems are twisted onto a piece of No. 10 wire, which is wrapped with yellow Cellophane ribbon. Candleholders to match are made by tying



four of the flowers and three or four leaves onto a cardboard form as previously described. Another interesting project is the boudoir lamp, Fig. 8, turned parts for which are dimensioned in the detail. Ventilation for a 25-watt showcase lamp is provided by keeping the straws separated with 1/16-in. cardboard spacers.

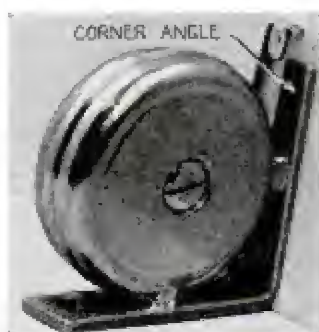
Large Breaks in Plastered Wall Are Easy to Patch



Always remove all cracked plaster, cut away damaged lath and then cover with piece of screen wire

Anyone can do a workmanlike job of patching breaks in plaster if a simple procedure is followed. If the break is a small crack, remove the crumbled material and undercut the edge of the firm plaster. But if the break is large and the laths are broken, remove the damaged plaster and cut away the broken parts of the lath. Then undercut the edges of the firm plaster and tack a piece of screen wire over the lath. Dampen the edges of the plaster so that the patching material will bond to it thoroughly. Regular patching plaster, which you can buy in any amount desired, is best, although a mixture of plaster of paris and water will do.

Corner Angle Improves Tape



Soldered to the case of a pocket tape measure, a 2-in. metal angle will permit the tape to be used in corners and similar places where it is difficult to obtain an accurate

dimension. The tape is read to the end of the angle, after which the length of the metal is added to give the accurate dimension from the corner.

—Daniel Reynolds, Pontiac, Mich.

Coil Spring on Cable Release of Camera Prevents Kinking

Kinking of the cable release on a camera when the latter is closed, or when a self-timer is used, can be prevented by slipping a small coil spring over the release next to the shutter as indicated. If the spring

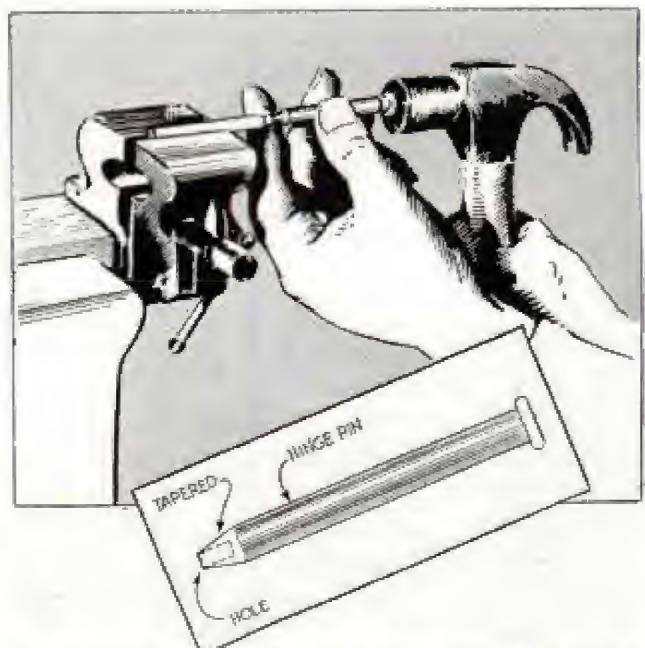


has a tendency to slip out of place, put a small piece of tape over one end.

Cutting Tenons for Ship Models

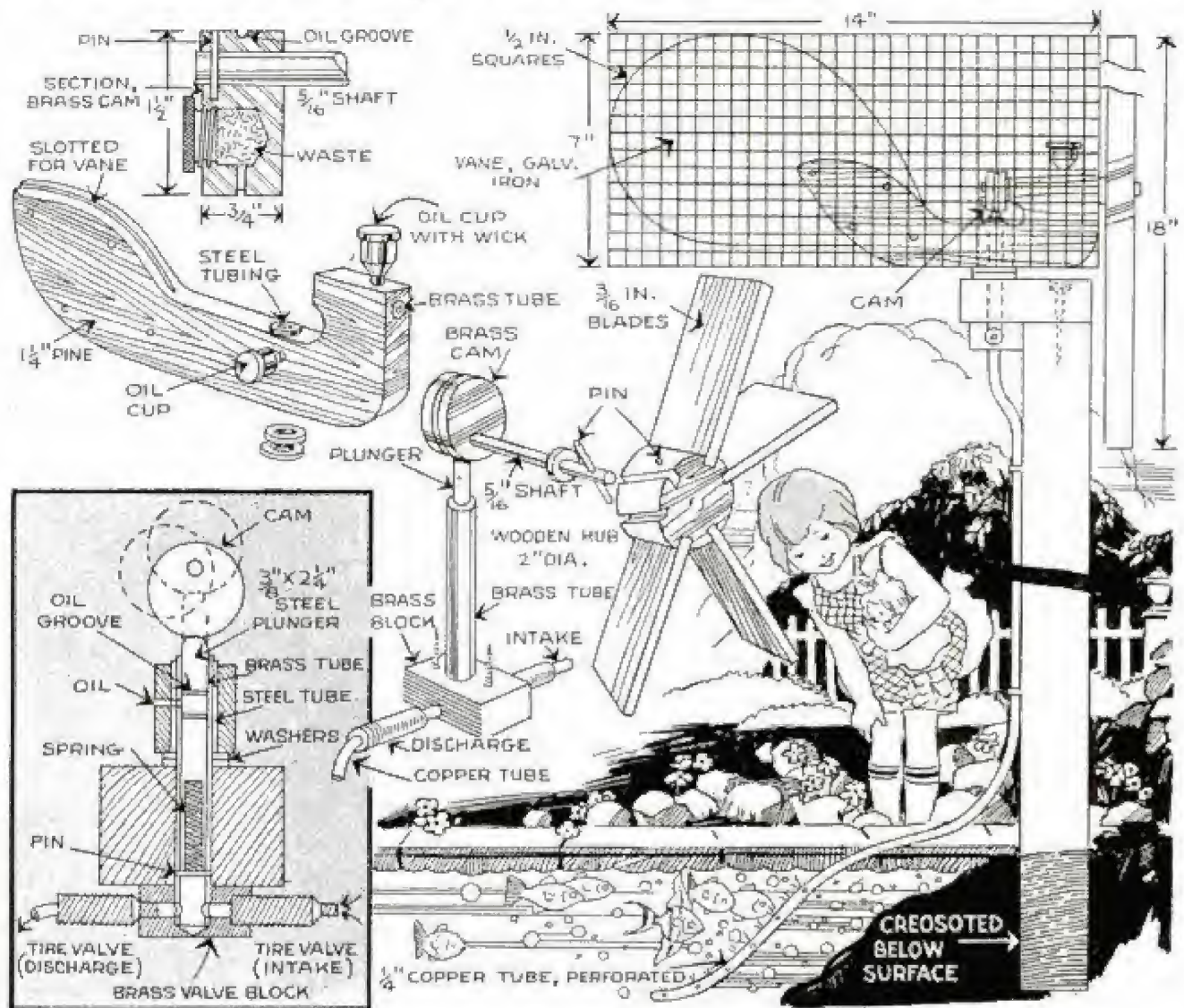
Here's a little tool that simplifies the tedious job of cutting tiny tenons on ship-model stanchions. All you do is grip the stanchion in a vise and drive the tool over the end of it to form the tenon. The tool consists of a hinge pin drilled at the end, which is ground to a taper to provide a cutting edge as indicated.

—Norman Sweat, Tippecanoe City, Ohio.



A tedious task is made much easier when the model-maker uses this tenon-cutting tool

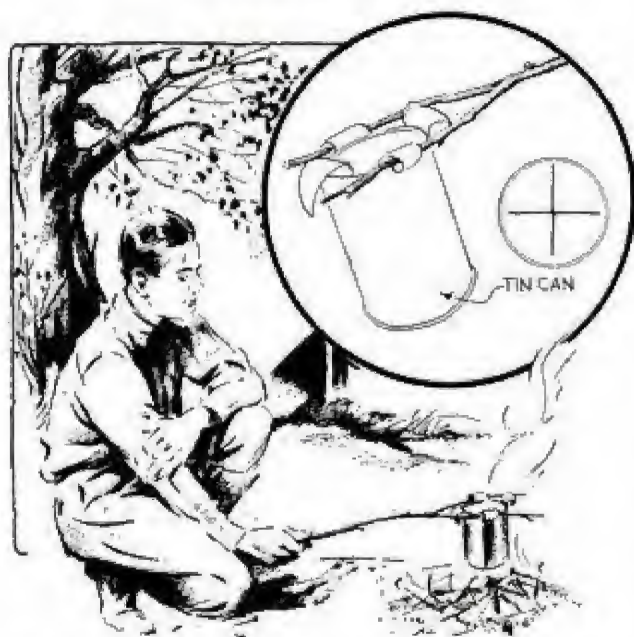
Windmill Pump Aerates Outdoor Fish Pool



Aerating outdoor fish pools is a simple matter with this windmill-driven pump. As long as there is any wind, the pump produces a constant supply of air, which is liberated under water. A wheel of 18 in. or more in diameter rotates a cam, which actuates the pump plunger or piston. The wheel is pinned through the hub to a steel shaft on the other end of which is a brass-disk cam also pinned to the shaft. If you care to go to the extra work, an oil pocket can be bored and fitted with a cap, and an oil groove turned in the periphery, as shown. The groove should be very shallow, and a small oil hole should be drilled in it to the pocket which is packed with oil-soaked cotton. The shaft is mounted on a wood bracket, and turns in a brass-tube bearing. The bracket swivels on another brass tube which serves as the pump cylinder. A steel sleeve over the brass

tube forms a bearing. The pump plunger is of steel with the upper end ground convex where it contacts the cam. A coil compression spring keeps the plunger against the cam. Ordinary tire valves are screwed into a brass block at the base of the pump cylinder, arranged so that the air can come in one and pass out the other. An oil cup with wick should lubricate the plunger. This is important, as it will also increase the efficiency of the pump. A 1/4-in. copper tube is soldered or connected to the discharge valve and carried down under the water of the pool. A number of very small holes, none over 1/16 in., are drilled in it, and the end is plugged with solder or pinched in a vise. If small ball-thrust bearings are available, operation will be greatly improved by installing them behind the windmill and on pump cylinder between the bracket and the top of post.

Emergency Dipper for Camp Use from Tin Can

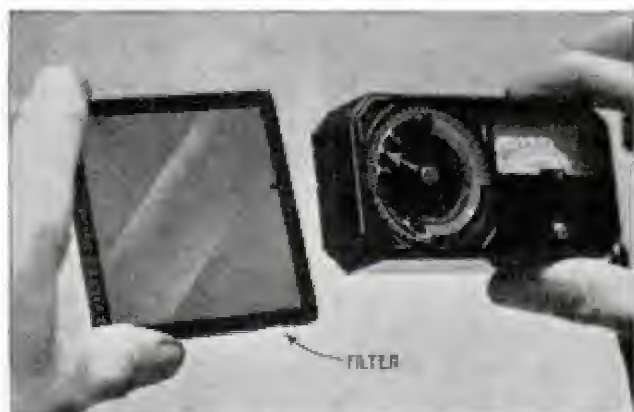


If you forget to take a dipper on your camping trip, this one from a tin can will serve the purpose

An excellent dipper or stewpan for use around the camp is assembled in a jiffy from a tomato can and a forked stick. When removing the contents of the can, the top should be cut across as indicated to provide four pieces which are rolled over the prongs of the stick. The utensil is especially convenient for dipping water from a spring, for heating coffee or other liquids over a camp fire, and for many other purposes.

Quick Way to Get Exposure Time for Photo Filter

If you have an exposure meter of the photoelectric cell type, you can get the correct exposure, when using a filter, by



Correct exposure time for filter found by taking reading on object through filter before taking photo

simply taking a reading on the object to be photographed through the filter. This is a timesaver for the photographer who carries a number of filters and cannot always remember their correct filter value.

—O. L. Snider, Universal City, Calif.

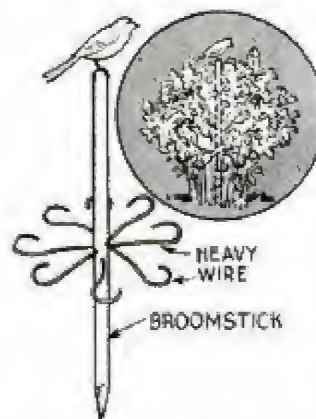
Water Gauge Made Easy to Read

Water-level gauges that are hard to read on boilers or tanks because of inaccessibility or poor light can be improved by placing a white card with heavy, diagonal lines behind them. The water in the lower portion of the glass acts as a lens, focusing the light strongly on the card. At the same time the effect is heightened by the bending of the oblique lines due to the higher index of refraction of the water.



—John G. Roberts, Chicago.

Invisible Support for Flowers



Completely concealed by the foliage, this flower support not only protects a plant, but a bird cutout realistically exposed at the top adds an attractive decoration. The support is made from a length of broomstick, which

has several holes drilled in a circle near the center to take short lengths of heavy wire, which have hooks bent at the outer ends to take the plant stems. The bird can be cut out of either metal or wood and should be painted with bright colors.

☞ When you use a mixture of soapy water and cleaning powder to wash walls, add enough flour to make a paste so that the mixture will cling to the wall long enough for the powder to dissolve the dirt.

BEFORE LAUNCHING YOUR BOAT

By Walter E. Stewart

PART II

THE hull of your boat must be sound and tight if you are to be free of worry when the wind makes up and the waves begin to pound. Now, while the boat is high and dry, pull out a little of the caulking between garboard and keel, at the stem, at the stern post, and at the turn of the bilge to see whether it has the white or grayish appearance of sound material or whether it is black and brittle, indicating rot. Only if the old caulking has decayed or fallen out should you plan



to recaulk the entire hull, Fig. 13. Remember that a seam which has opened as a result of a winter's drying out will promptly close again after the boat has been in the water a short time. It is only necessary to fill these seams with an elastic seam composition to keep the water out of the boat until the swelling has had time to close the opening. When putting in the compound do not attempt to pack the seam full. Leave a slight hollow to the outer surface so that when the planks swell the compound will be squeezed just flush and not beyond the planking. Take a pointed knife and test all planking and deadwood for decayed spots, Fig. 12. The only cure for rotten wood is replacement.



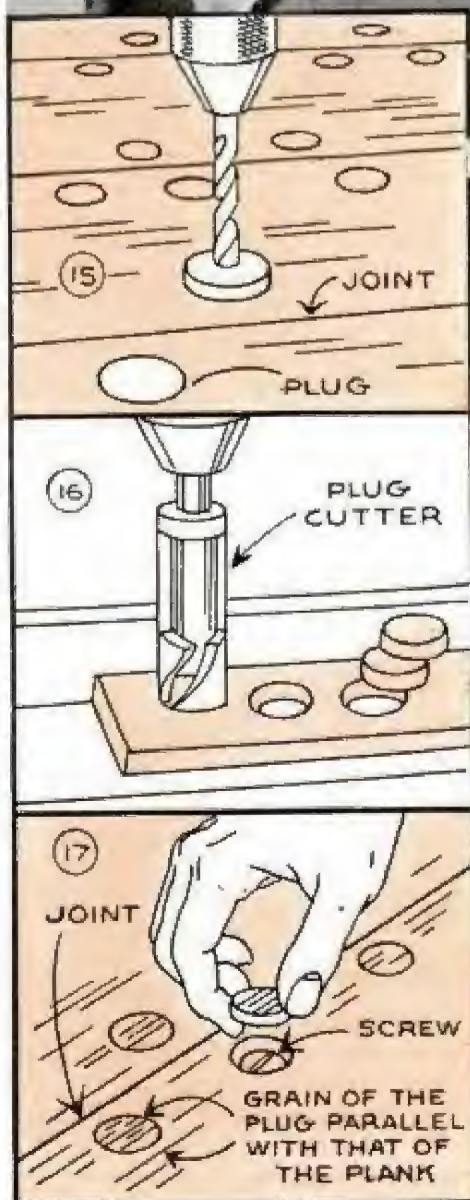
If rust from galvanized fastenings streaks the topsides of your boat, dig out the plug over each rusted fastening and scrape it clean. Blow all the flakes of rust out of the hole, give it a thick coat of white-lead paint, and fit in a new plug. In small boats putty instead of wooden plugs may be used to fill the hole. The most universally used putty for this purpose is a paste made with whiting and just enough white lead in oil to make it of good working consistency. In making new wooden plugs be sure that the grain of the wood runs at right angles to the axis of the plug, otherwise swelling of the plug will cause it to protrude beyond the planking. When necessary to renew plugs over the heads of screws holding deck and side planking, proceed as in Figs. 15, 16 and 17.

The putty mentioned above is also good for filling in very small cracks or chipped places in wood or paint. Before starting to paint, Fig. 11, scrub the topsides with

fresh water and a strong cleanser. Any grease or tar that remains on after the scrubbing can be removed with kerosene. Tar or grease left on will surely strike through new paint. After cleaning the topsides roughen the surface slightly with No. 00 sandpaper so the new paint will form a good bond. Normally you will need to apply only one coat of flat paint and one of semi-gloss. In case the old paint is in very good condition the one coat of semi-gloss will be sufficient. It is well to remember that discolorations show through glossy coats much more than through flat. Some boatmen say that the entire paint job on the topsides should be flat. Their theory is that by the end of the season most of the flat paint will have powdered off, eliminating the need of the occasional burning off which otherwise would be required.

If the varnish on bright work, Fig. 14, is gone to the extent that the wood has become weather-stained, the only thing to do is remove the remaining varnish, bleach the wood, sandpaper smooth, and apply at least four coats of new varnish. The best varnish you can buy is the cheapest for use on the outside of a boat.

Too many coats of paint on a canvas deck is a sure cause of checking, so if your deck is in good condition, touch up any thin spots, sandpaper lightly all over, and apply only one coat of finishing paint. Remember that it is the varnish in paint that causes it to crack. If the deck is already badly checked, all the old paint must be removed, for no amount of sandpapering and filling-in will ever conceal serious checking. To cover up relatively light checking, sandpaper the edges down smooth, with a very small brush fill in the crack with thick paint, allow to dry, sandpaper again, then

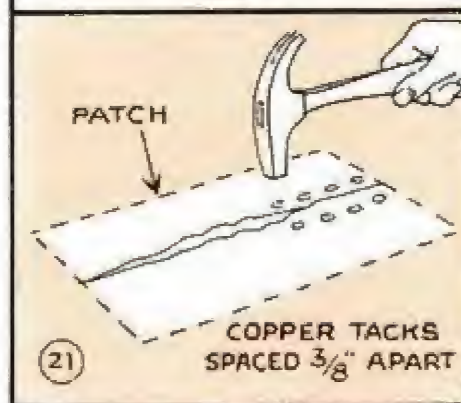
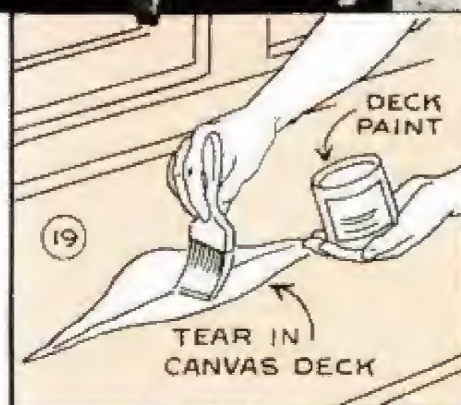


paint the entire deck. Get the bottom of your boat perfectly smooth, even if it is necessary to use a plane to do it, before you paint. When getting the barnacles off be sure to get not only the projecting pyramid, but the tightly adhering base as well. All copper anti-fouling paints are best applied immediately before launching, and be sure to follow the maker's directions as to thinning or the lack of it. Any deviation from the tested formula is likely to be detrimental to the protective properties of the paint. Bronze bottom paint usually should be permitted to dry and harden before the boat is launched, but be guided by the maker's directions if they differ from this.

The rigging of sailing craft is as vital as the power plant in motorboats. If any line is of doubtful strength, replace it. Should a halyard part or a sheet let go when you are in a blow on a lee shore you will always regret the few dollars you have "saved" by using the old rigging one extra season. This is not advice to replace your rigging every year, for this extreme is seldom necessary. However, it is always wise to reverse ends on both halyards and sheets so as to shift the wear to another part of the line. Backstay whips also should be reversed. Make sure the sheaves in all blocks run smoothly, that all blocks are large enough to permit the line to reeve through them freely, and that shackles, sister hooks, and snaps are not worn dangerously. Fittings at the mast head, of all places the most difficult to get at in an emergency, are often neglected. Go aloft and replace any worn, frayed, or rusted parts. See that your standing rigging has not been weakened by rust, and if it is galvanized steel give it at least one coat of exterior aluminum paint. Cut off the old and make new splices over the thimbles at the ends of your two or three anchor lines.

In a final checking over, clear out the strainers on all water intakes. If necessary, replace the rubber connecting hose between hull connections and metal water lines. All through-hull connections in your boat should be fitted with sea cocks. You can make a neat repair for small tears in a canvas deck by slipping a piece of canvas considerably larger than the hole under the edges of the surrounding deck material and spacing copper tacks not more than $\frac{3}{8}$ in. apart all around the opening. See Figs. 19, 20 and 21.

Every season a few boats slide into the water, Fig. 18, and immediately develop a serious leak. After much pumping the owner remembers that he forgot to plug the drain hole in the garboard plank. So, as soon as you have finished scrubbing the bilge make a new plug and drive it home.



Leaves Troweled in Sidewalk Produce Neat Border

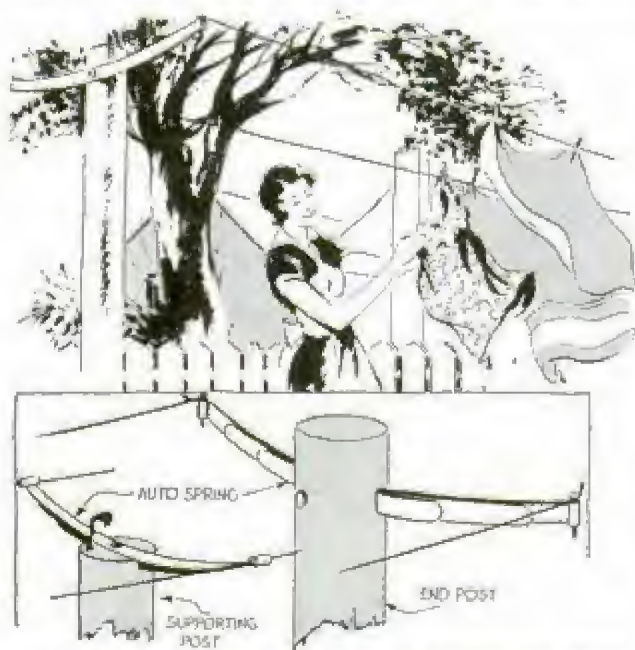


A variety of designs can be worked out by using different shaped leaves of various trees

After applying the finishing coat to a freshly laid sidewalk, tree leaves were troweled into the wet surface along the edges. When the concrete had set and the leaves dried, they were washed away with a garden hose, leaving their impressions in the surface. The border shown was made with elm leaves.

Clothesline Attached to Spring Always under Tension

To retain tension on a clothesline without danger of having the posts loosen under vibration of the clothes whipping about



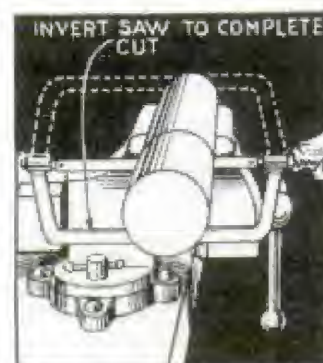
Auto-spring crossarms on your clothesline posts keep lines taut without props

in a wind, replace the wooden crossarm on one support post with a discarded auto spring. If the lines are of long span, they may be supported with another spring set into the top of the center post. In this instance, the wires pass through the eyes in the ends of the spring.

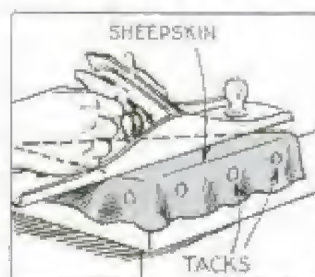
—G. E. Hendrickson, Argyle, Wis.

Hack-Sawing Large Work

When cutting off a pipe or shaft that is larger in diameter than the clearance of the saw frame, cut in to the work as far as you can. Then unfasten, leaving the saw blade in the work, and attach the frame from the opposite side of the work. When the cut is completed, the severed ends will be smooth.



Sheepskin to Oil Hand Plane



To keep the face of my hand plane slick, I frequently draw it across a piece of lard-oil impregnated sheepskin, which is tacked to one corner of my workbench. This leaves a slight film of oil and greatly reduces friction when using the plane. Keeping a coating of oil on the steel also prevents the formation of rust.

—Frank Andres, Seattle, Wash.

Cool Handle for Your Iron

If a strip of corrugated cardboard is wrapped around the handle of an electric iron and fastened with tape, the handle will not become uncomfortably hot when the iron is used for long periods.

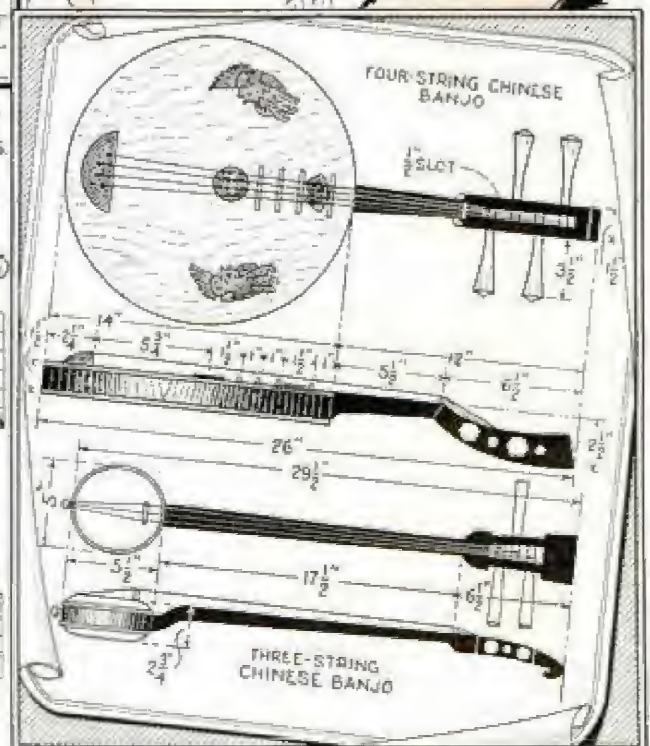
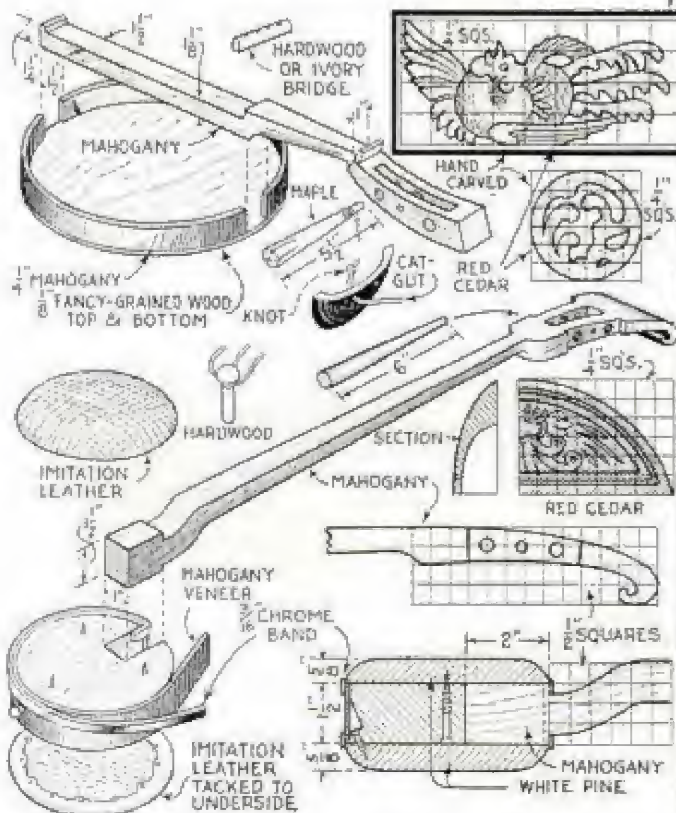


CHINESE BANJOS

add decorative touch to den



These copies of ancient Chinese banjos will give your den or recreation room a novel, oriental touch. Making them involves nothing more than some neat fitting and hand carving. If the carving designs shown here are too intricate to suit you, simpler ones can be substituted



Heavy Outboard Motor Moved on Detachable Wheels

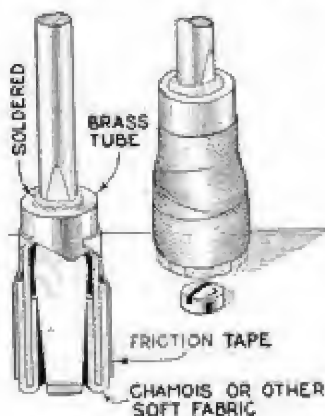


Wheels and axle from boy's wagon quickly attached to outboard motor to move it wheelbarrow fashion

Having an outboard motor that was too heavy to carry, I moved it wheelbarrow fashion on a couple of detachable wheels. These consisted of the wheels and an axle obtained from a boy's express wagon. In my case, the axle was bolted to lugs on the gas tank of the motor, both the axle and lugs being drilled to take the bolts. If your motor has no lugs on the tank, iron brackets usually can be slipped under some bolt or cap-screw heads for attachment of the wheels.

—Lloyd Jensen, Los Angeles, Calif.

"Fur-Lined" Screwdriver Protects Surface of Finished Work



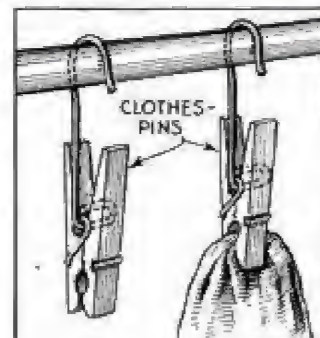
Improving on the old method of soldering a piece of tubing around the blade of a screwdriver to keep it from slipping off a screw head, one woodworker covers the tube inside and out with chamois skin or soft fabric.

The tube should be large enough to glue the skin or fabric inside, after which the latter is turned up over the edge and is

held in position by a wrapping with friction tape. The protective lining avoids marring either the finished work or the head of the screw.

Clothespin on Wire Hook to Hang Garments

In our home we find that spring-type clothespins fitted with hooks are very handy for hanging up caps, hats and garments that are usually hung on a hook. The clothespins make the use



of hooks on the closet walls unnecessary. The hooks are pieces of heavy wire run through the coil springs of the pins and bent over as indicated by the dotted lines.

—Herbert T. Ludgate, Toledo, Ohio.

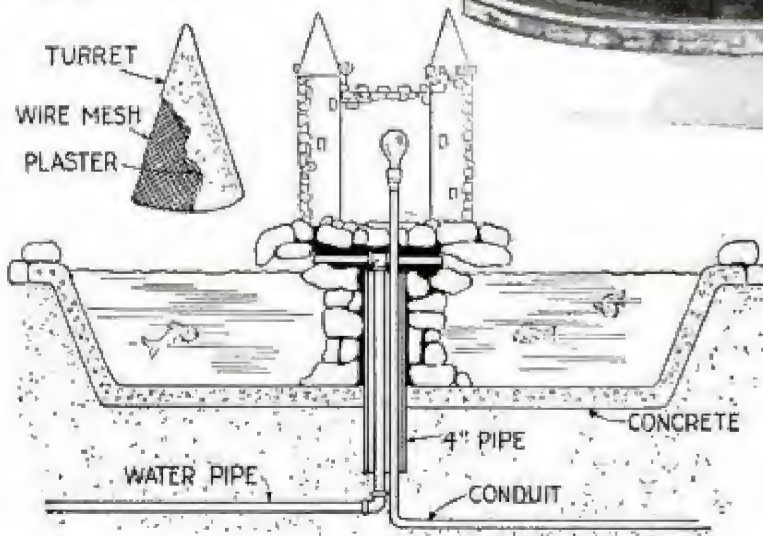
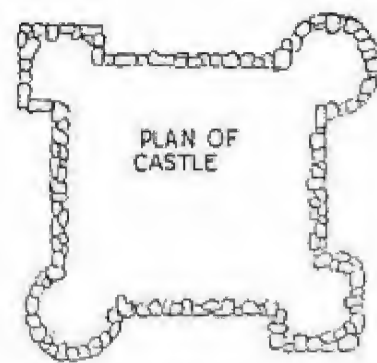
Dust Removed from Photo Films with Electrified Comb

Tiny specks of dust and lint are easily removed from rolls of miniature-camera film with an ordinary hard-rubber comb which has been rubbed briskly with a silk handkerchief. Then the charged comb is brushed along the surface of the film, and it will pick up the dust specks.



Rubber comb charged with static electricity removes invisible dust specks from miniature-camera film

Decorative Feudal Castle for Your Fish Pool



Resting in the center of your fish pool, this model gives a realistic impression of the old-time castle surrounded by its protective moat. Stones and mortar are used throughout, the four towers being capped with turrets of wire mesh covered with plaster. Electric lighting is optional and can be installed as indicated, if desired

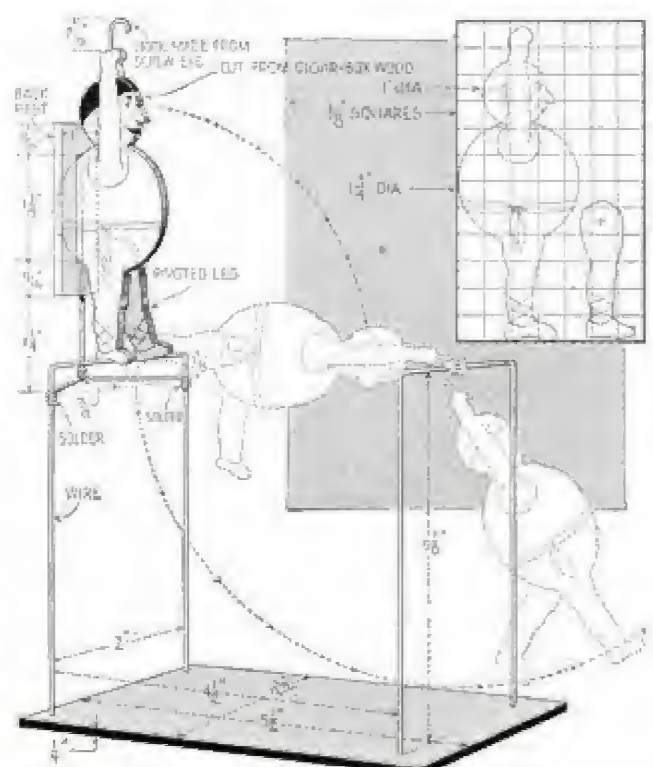
This Tumbling-Acrobat Toy Will Delight Small Children

Here's a simple toy that will give the children a lot of fun. When the acrobat is knocked over, it appears to be falling to the floor. But just at the crucial moment, it hooks onto the next bar and swings with ease. A slotted back rest keeps the acrobat in position for the next act. The figure is cut out of cigar-box wood with the arm and the right leg in one piece. The left leg is cut separately and swings on a pivot to give movement. A couple of pencil lines will establish identity of the arms and both sides.

Diluting Showcard Colors

The trick in using showcard color is correct dilution. For a really good job on large surfaces apply a second coat after the first has dried thoroughly. Beginners usually fail to allow for the fact that the color dries out quite a bit lighter. Frequently a drop of glycerin will improve the color work.

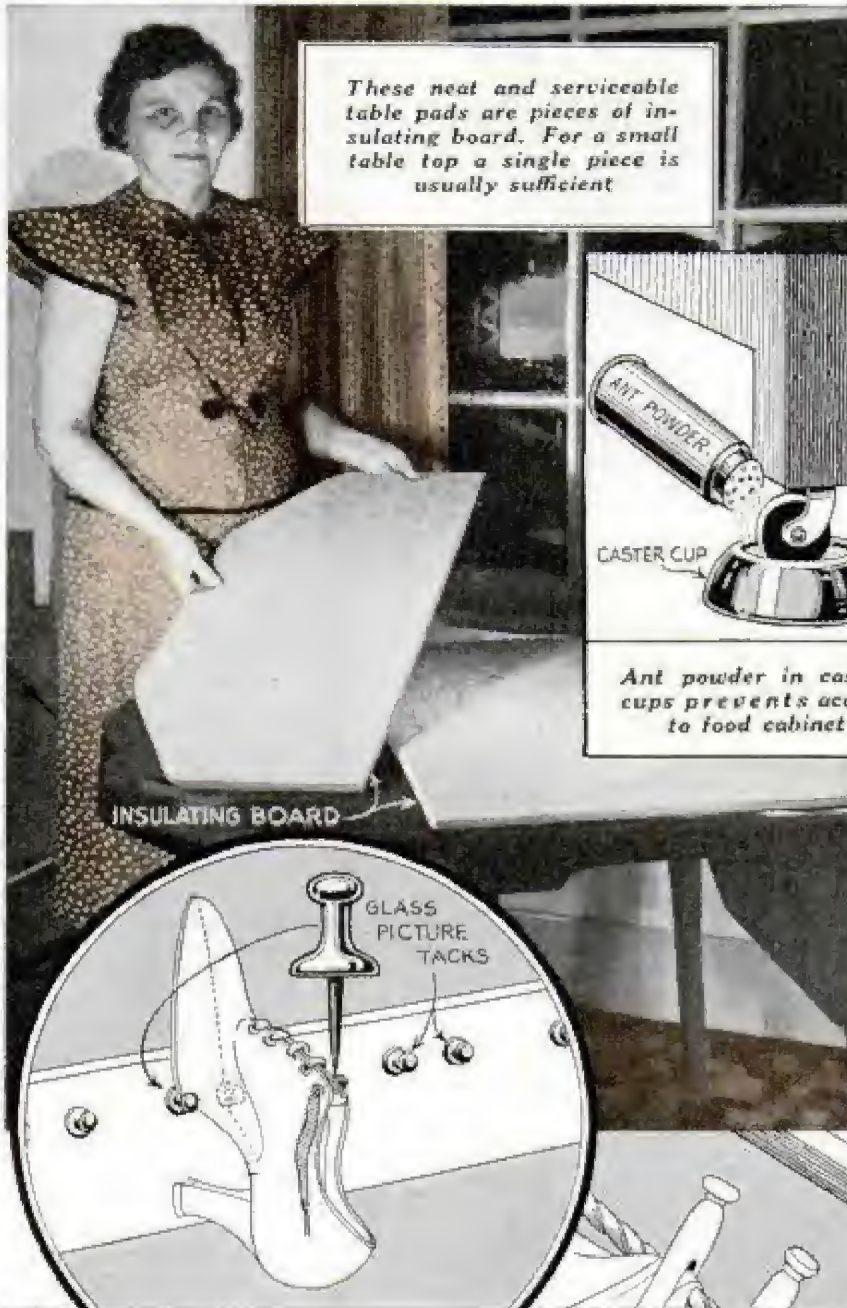
—Leonard F. Dodge, Machias, Me.



Dropping from a vertical position on one bar, the acrobat grabs the second bar as he falls and swings safely in a realistic manner

HOME Solved

These neat and serviceable table pads are pieces of insulating board. For a small table top a single piece is usually sufficient



INSULATING BOARD

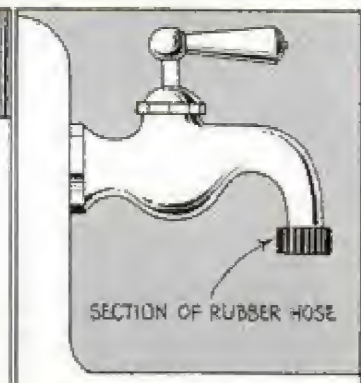
GLASS
PICTURE
TACKS



ANT POWDER

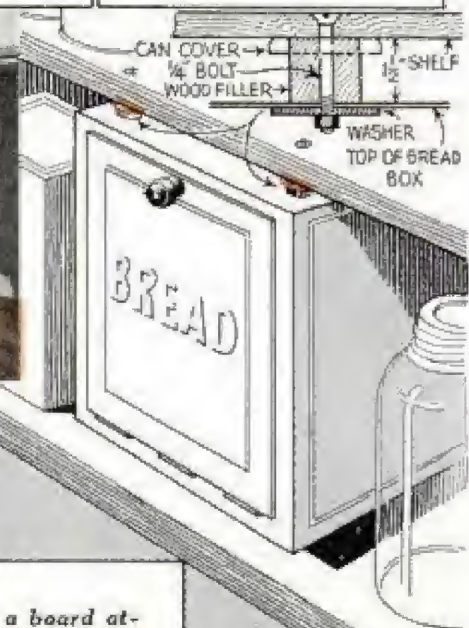
CASTER CUP

Ant powder in caster cups prevents access to food cabinet



SECTION OF RUBBER HOSE

Piece of rubber hose on faucet helps to avoid breaking glassware

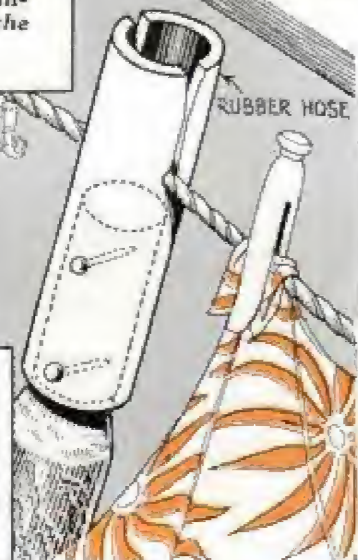


Shoe hangers are provided by driving glass-head push pins into a board attached to the back of the closet door as shown in the circle above. To keep insects out of the bread box suspend it from the pantry shelf as detailed at the right. Be sure the sides or back of the box do not touch a wall



SODA STRAW

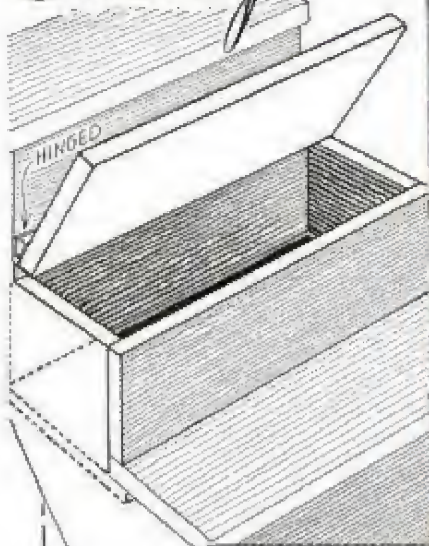
Short-stemmed flowers slipped into soda straws are easy to arrange in a bouquet of long-stemmed flowers so that they may be placed in a tall vase. Right, a clothes pole will be non-slip if a short length of rubber hose slit as shown, is tacked to the upper end



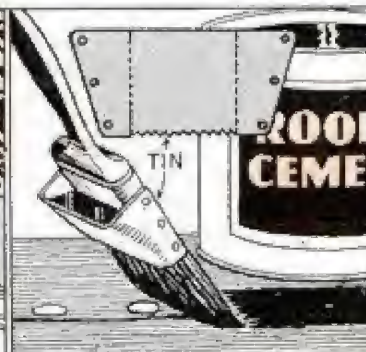
RUBBER HOSE

PROBLEMS

Easily



Left, boxing-in the space under a basement stair step and hinging the tread to the riser, provides a handy place to keep odds and ends. Right, the job of laying linoleum is simplified by lifting corners and edges near the walls with a household suction cup; glycerin applied to the cup edge makes it hold tightly



A reservoir on the ferrule of a brush feeds paint or roofing cement uniformly

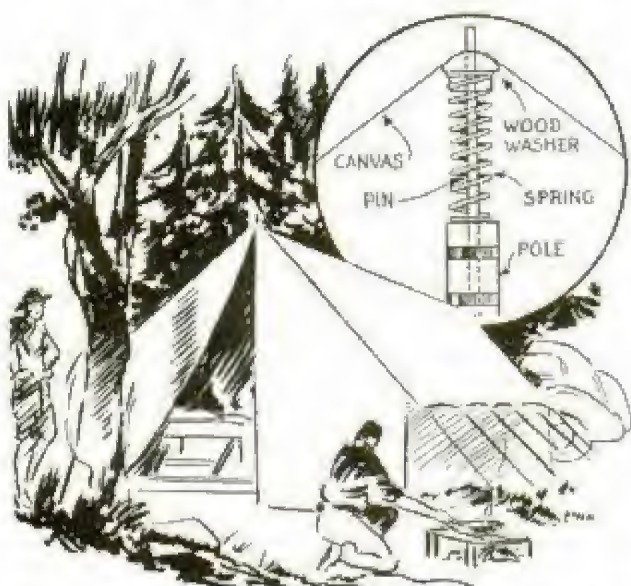


Corner braces used to hang dry cells from insulating strip



If your basement laundry stove smokes in the summer, open the cleanout door at the base of the chimney, place a roll of newspaper inside and ignite it. The heat drives the damp air from the chimney and restores the natural draft. Right, the next time you clean your library books try wallpaper cleaner to remove dust from both the pages and covers

Tent Ridge Pole Rests on Springs to Hold Canvas Taut



Springs under ridge pole provide pressure to keep canvas stretched neatly regardless of weather

To keep the seams of his tent from being damaged by excessive shrinkage when the canvas becomes damp, and also to avoid

excessive sagging when the cloth dries out, one camper uses coil springs under the ridge pole as indicated. The springs provide a pressure against the ridge pole which keeps the canvas stretched neatly.

Emergency Vise for Fishermen

Fishermen who have to repair or construct flies in camp can use a tin can and a pair of pliers as an emergency vise. The can is driven into the ground, bottom side up, and holes are punched in it to receive the handles of the pliers when closed. The hook is



placed between the jaws of the pliers and is held securely by forcing the handles into the holes in the can bottom.

What Kind of Boat Do You Want?

Whether it's a simple rowboat, an outboard runabout or a family cruiser, you'll find something you want among our blueprints. These are some of the popular prints in the list:



21-Ft. Sloop "Arrowhead"—944 to 951

"ARROWHEAD" SLOOP—944 to 951: 21-ft. sailboat that can be built by average craftsman. Accommodates up to 10 passengers. Set of 8 prints \$1.50.

"HI-HO" 14-FT. FAMILY RUNABOUT—840 to 845: Powered by 11 to 22 hp. outboard or a converted Ford motor. Set of 6 prints \$1.00.

"ROAMER"—765 to 770: Outboard cabin cruiser. 16 ft. long, 66 in. beam. Requires outboard motor of 20 to 36 hp. Set of six prints. \$1.00.

12-FT. ROWBOAT—707: Flat bottom. Can be used with small outboard motor. 25c.

"SEA SAUCER"—893: Lightweight sailboat. Length 9½ ft. Planked with 3/16-in. plywood. 25c.

10-FT. ROWBOAT AND AUTO TRAILER—551: Wonderful combination for week-end trips. 25c.

CANVAS-COVERED KAYAK—928 and 929: Light framework covered with canvas. 17 ft. in length and accommodates single passenger. Two prints 50c.

Any six of these blueprints (not sets of prints) will be sent postpaid upon receipt of \$1.00

Blueprint Department, Popular Mechanics Magazine, 200 E. Ontario St., Chicago

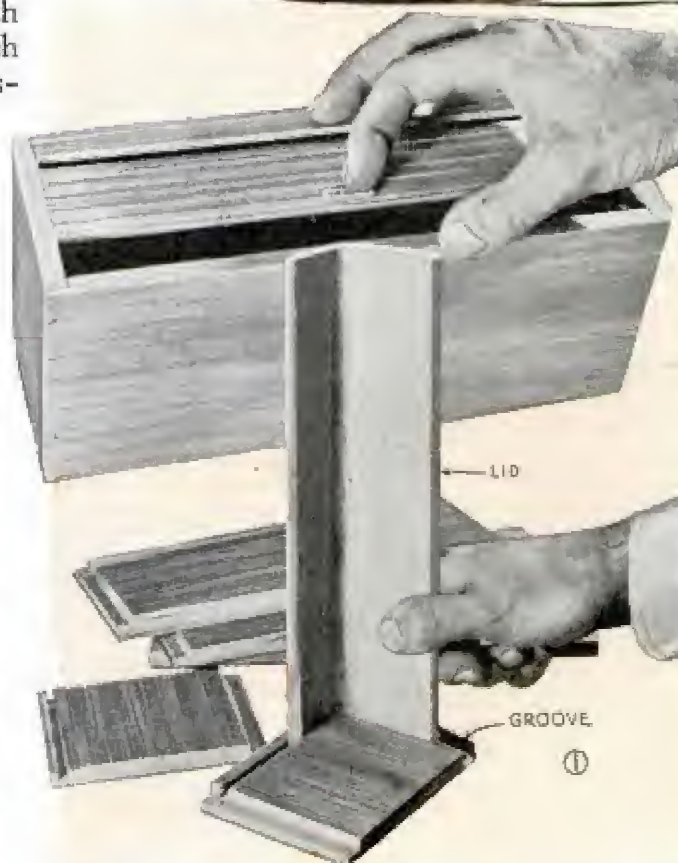
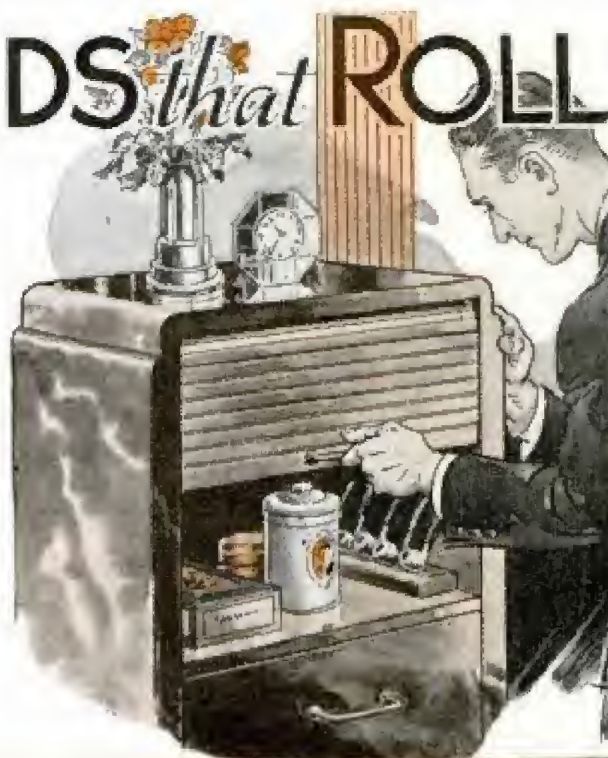


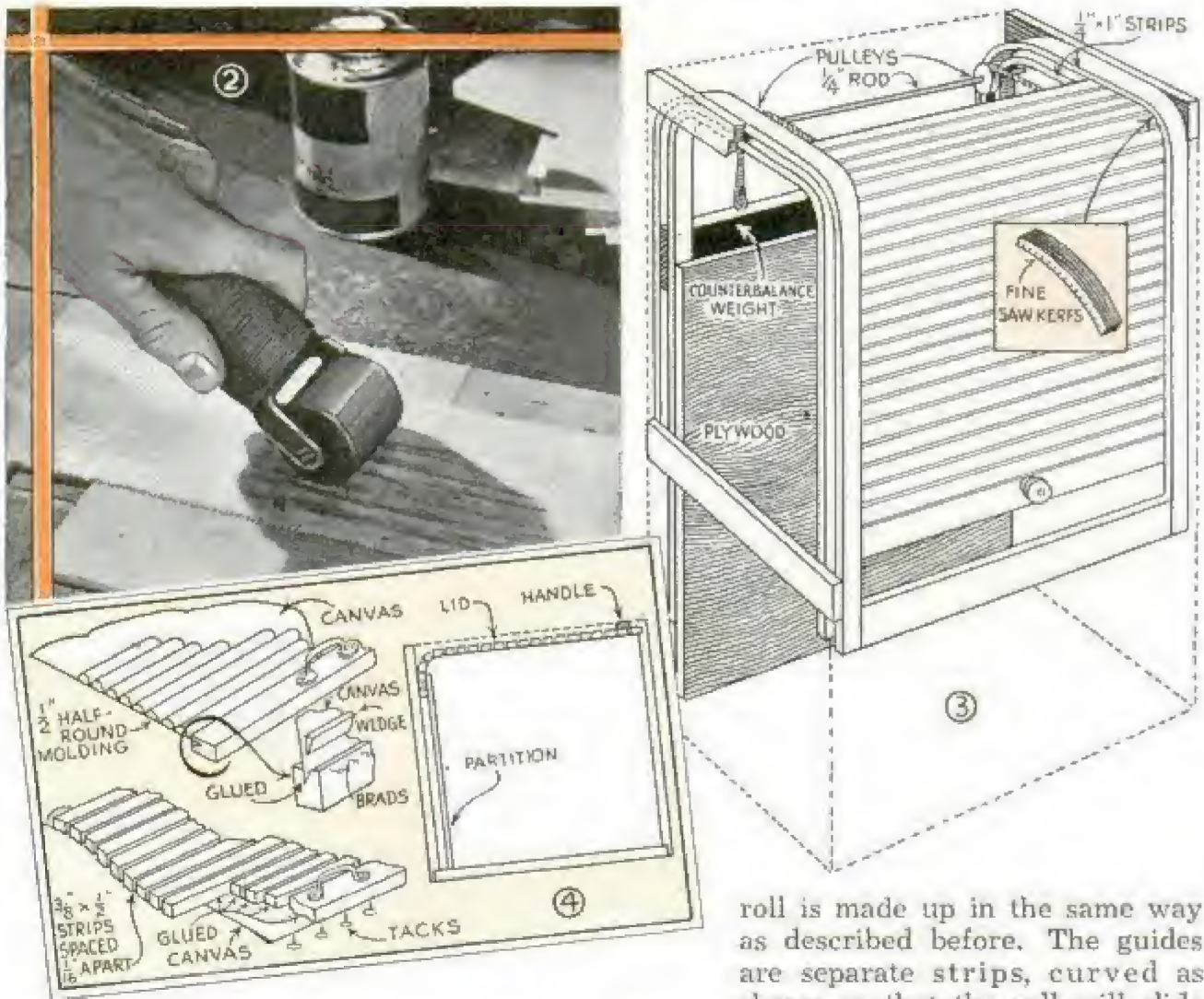
DOORS *and* LIDS that ROLL

HERE'S a way to add a novelty to your homemade smoking stand, clothes closet or bookcase. Neat and practical, too, because such a roll-away door keeps out the dust, can be finished in attractive colors and does not swing out like the conventional door. You can use the same construction for a partition or for an inside opening where there is no room for a swinging door.

Although there are variations, in essential the lid or roll consists of a number of narrow strips laid side by side and glued to heavy cloth, Figs. 1 and 4. The strips must be exactly the same length and identical in sectional size. The cloth to which the strips are glued is cut to the width between the guides or grooves in which the ends of the strips slide. This is necessary to prevent the cloth from binding. Before gluing up the roll, make a jig to hold the strips firmly in position and spaced about $\frac{1}{32}$ in. apart. Very little glue is needed to stick the cloth firmly to each strip. The trick in making a successful job of this is to spread a thin line of glue on the center of each strip, then place the cloth and roll it down into firm contact as in Fig. 2. Endpieces of the box are grooved to receive the ends of the strips, which slide in the grooves. A handle is provided on the sliding cover as in Fig. 1. The slot formed where the lid bends downward is covered by a strip running parallel to one of the longer sides. The side piece opposite has a shallow groove to receive the edge of the lid.

Variations include an attractive door or lid made from dowel rods fastened either to cloth or strung together with





cord running through drilled holes. Strips of various colors can be assembled into attractive patterns. Steel rods or tubes can be strung on wires or chains and so on. Fig. 3 shows the type construction you would use in installing a large sliding door, such as that in a closet or partition. The

roll is made up in the same way as described before. The guides are separate strips, curved as shown so that the roll will slide easily. When the installation is made, these strips or guides must be spaced equally throughout their length so that the roll cannot buckle. A counterbalance is necessary for a large door. The weight can be concealed behind a partition and connected to the roll with cords running over pulleys.

Float-Controlled Electric Alarm Is Handy for Icebox Pan

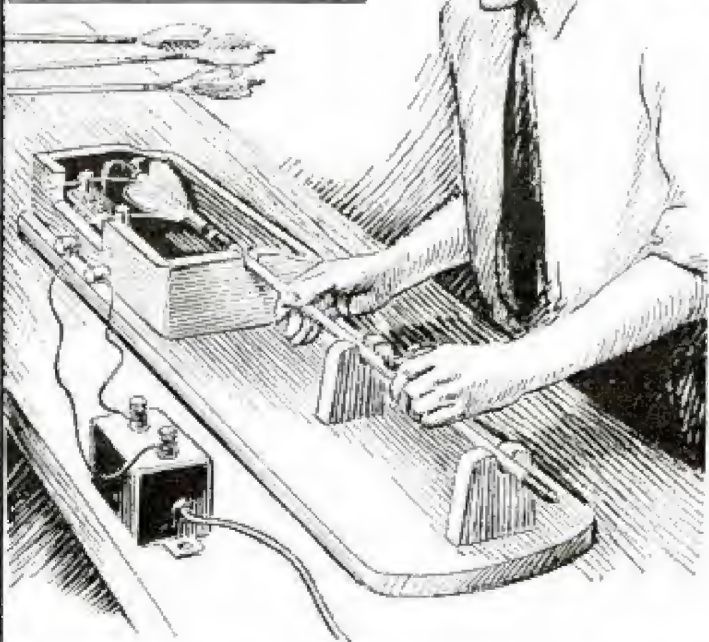
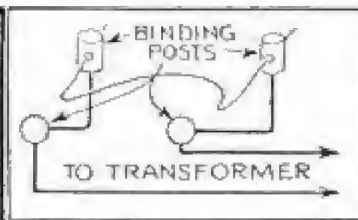
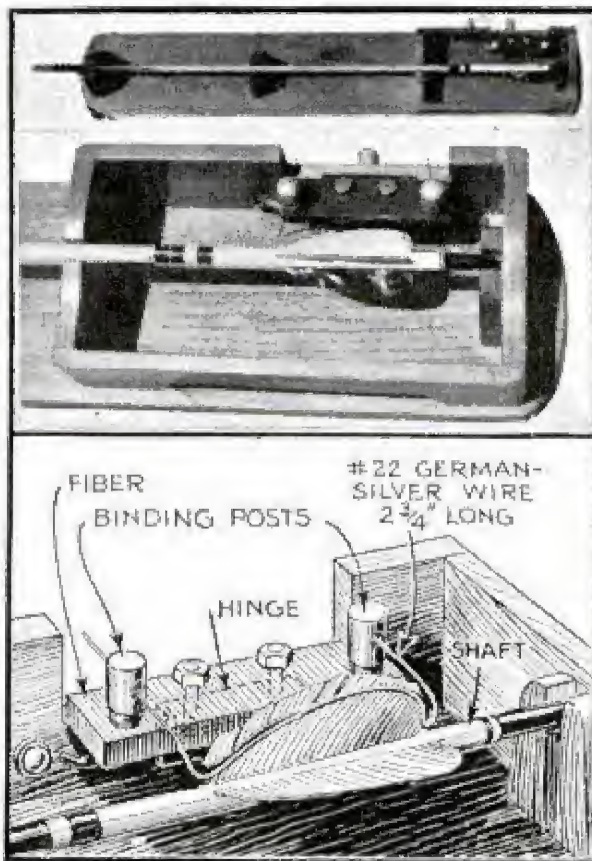


Especially useful to hook over the edge of your icebox drip pan, this alarm sounds a buzzer when the pan is filled. It is also handy to hook over the edge of a pail or other container, which is slowly being filled with liquid. The alarm consists of a dry cell and a buzzer connected to a pivoted cork float with strips of copper. The circular detail shows how the float closes the circuit when raised by the liquid.

—W. E. White, Plymouth, N. H.

❑ If apples are slit with a knife in three or four places before baking, the skins will not wrinkle in the oven.

Electrical Trimmer Shapes Arrow Feathers

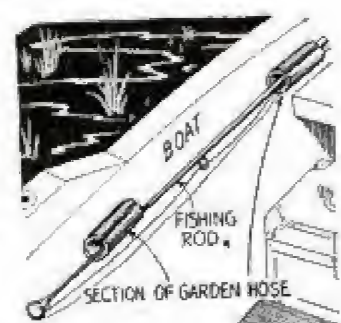


An important point in producing good arrows is accurate trimming of the feathers, which is often neglected because lack of experience or proper tools makes the job difficult. The electric trimmer shown above enables anyone to do the job in a professional manner. The trimmer consists of a hardwood base carrying notched supports in which the arrow is laid so that the feathered end can be rotated against a hot resistance wire shaped to the correct contour. The base is 5 by 24 in., and the inside dimensions of the boxlike end are $3\frac{1}{2}$ by 7 by 2 in. This allows the full, uncut feathers room to turn and fall, and also allows cresting the entire painted part of the arrow without fear of smearing. The notches in the box ends and in the support pieces are $\frac{3}{8}$ in. deep with the back sides cut straight. This permits one side of the arrow, regardless of its diameter, to be a constant distance from the trimming wire. At the back of the box, a $\frac{3}{4}$ by 3-in. section is cut out and a piece of fiber the same size is substituted. This is hinged at the bottom so that it may be dropped to a horizontal position or left straight up out of the way when not in use. Binding posts

in this piece hold the resistance wire and are connected to posts at the rear of the box. Clearance between the shaft and the closest points of the wire should be about $\frac{1}{32}$ in. Operating temperature of the wire must not be too hot or too cold. Using a 6-volt transformer, a No. 22 German silver wire between $2\frac{1}{2}$ and 3 in. long will give excellent results. The wire must be almost white hot, otherwise the feathers will merely melt and gum the wire.

Fishing Rod Carried in Boat on Rubber-Hose Supports

Slit along one side and nailed or screwed to the inside of a boat, two short pieces of garden hose provide safe supports for carrying a fishing rod. These are better than metal hooks or wood pegs, which might cause accidental injury to the occupants.



Finger Loop on Stepladder Hinge to Avoid Pinching Hand

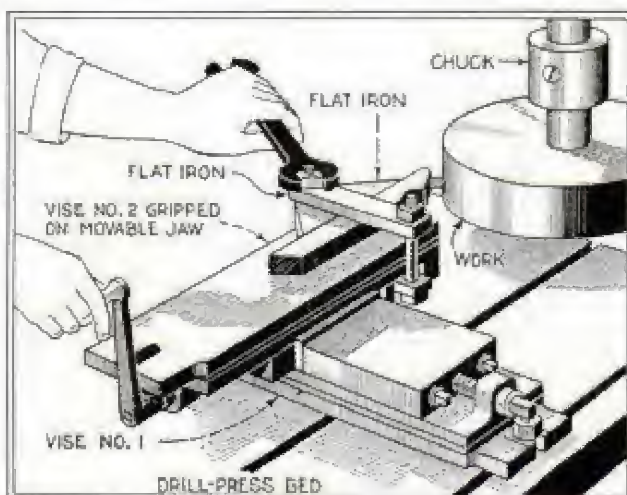


Loop on hinge of stepladder to insert finger for opening without danger of pinching the hand

When putting new hinges on his stepladder, a carpenter made them from pieces of flat iron and formed a loop on one leg of each hinge to take his finger. This enabled him to open the ladder with little risk of pinching his hands.

Quick Setup for Turning Metal in a Drill Press

In an emergency, light metal turning can be done in a drill press with the setup shown. Two vises are used, one being bolted to the table and the other one clamped upside down in its jaws at right angles as indicated. Then, with the tool



Emergency turning jobs done in drill press by using two vises when no lathe is at hand

holder clamped to the bottom of vise No. 2, it is used as a movable cross head when the work is held in the drill-press chuck and rotated.

Funnel on Glue-Brush Handle to Keep It Clean

To keep the handle of a glue brush clean so that it would not stick to his fingers, a shipping clerk cut off part of the neck of a small funnel and tacked the latter to the handle as indicated.

Also, the funnel serves as stopper for the glue can when the brush is not in use.



Economical Coops for Chicks from Old Oil Drums

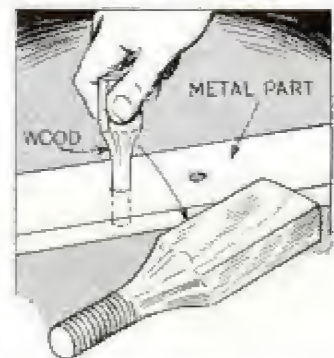


An old oil drum will provide two economical coops for small chicks when it is cut in half lengthwise. The coops are weather and vermin proof and will last indefinitely if painted. A door is

cut in one end, and a number of 1/2-in. holes are drilled in the end near the rim to assure ample ventilation.

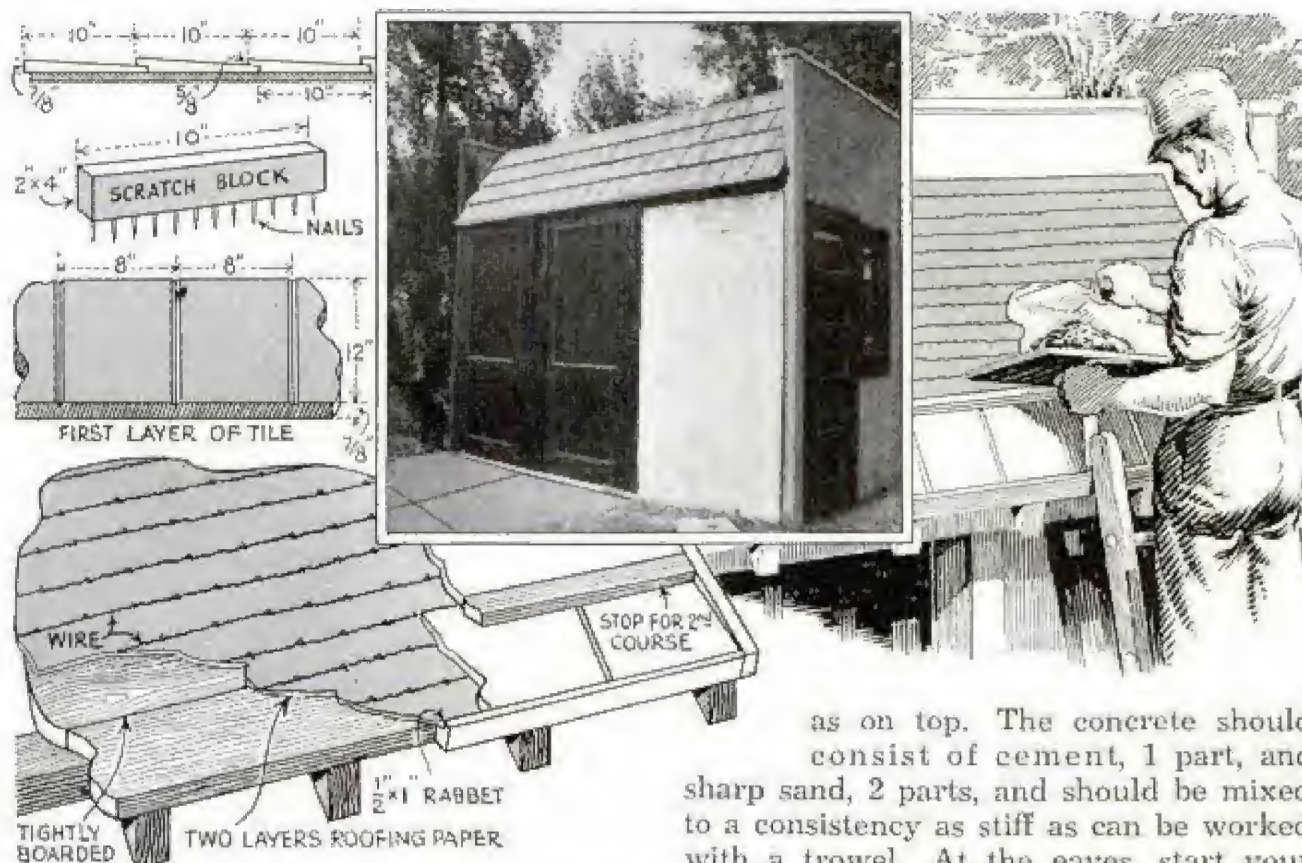
Counting Threads in Tapped Hole

Carefully whittled to the correct diameter, a stick will serve to determine the number of threads in a tapped hole. The small end is simply screwed into the hole. This cuts threads in the wood that can be counted easily when the stick is removed.



—A. H. Vance, Harshaw, Wis.

Spanish Flat-Tile Roof Imitated with Cement



You'll be surprised how easy it is to imitate Spanish flat tile with cement on a short roof such as the garage shown in the photo. Of course, the job can be done on larger roofs, but they must be rigidly reinforced to support the weight, as any tendency to sag will crack the concrete. The roof to be tiled must be boarded tightly and covered with a double layer of heavy tar paper. On this, staple pieces of No. 9 iron wire about 3 in. apart and kink it so that cement can get under it as well

as on top. The concrete should consist of cement, 1 part, and sharp sand, 2 parts, and should be mixed to a consistency as stiff as can be worked with a trowel. At the eaves, start your first slab, making it 12 in. wide and 1 in. thick at the lower edge, tapered to $\frac{1}{2}$ in. at the top. After the concrete has set about 45 min., score the surface at 8-in. intervals to simulate the tile, sinking the score lines a distance equal to about one third the thickness of the concrete. Then, using a scratch block like the one shown, scratch the surface about $\frac{1}{4}$ in. deep. Now nail a 1 by 4-in. wood strip 10 in. above the lower edge of the first slab and start the next one.

—A. Campbell, Clarendon Hills, Ill.

Eccentric Tool-Post Ring Reduces Leverage When Boring

This eccentric tool-post ring tends to reduce chatter when boring or threading internally in a lathe by giving support close to the work, thus reducing the leverage on the tool. By turning the ring, it can be adjusted to support the yoke of the boring tool holder. The result is less strain on the parts, and ability to take heavy cuts. Thickness of the ring should be a little less than the outside edge of the usual ring. The wedge is laid on top of the tool to give the set screw a bearing.

—R. F. Starzl, Lemars, Ia.



Wrapping Paper Cut in Sheets for Duplicate Packages

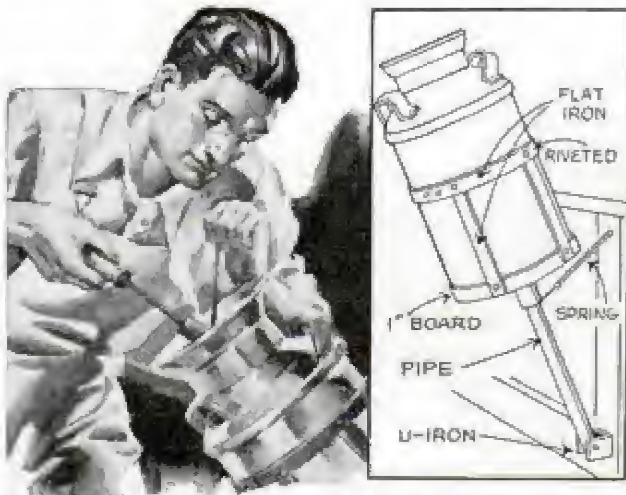


This method of cutting wrapping paper into sheets will save time during rush hours

When a number of packages of similar sizes are to be wrapped, much time can be saved if the paper is first cut into sheets as indicated. It is unrolled on a piece of cardboard equal in width to about half the desired length of the sheets, after which a sharp knife or razor blade is used to cut the paper along one side.

Pivoted Saddle Holds Milk Cans While Soldering Them

As most of my work is repairing large milk cans, which are difficult to hold at the correct angle, especially when soldering the inside bottom seam, I rigged up this saddle to hold them. It enables me to turn the cans or raise them up or down at



Milk cans held in this saddle can be turned or raised and lowered to any desired height

will, and consists of a circular basket, which is fastened to an arm pivoted to a wall. The basket is made of flat iron and the bottom is a wood disk. This is drilled in the center to take a pipe arm, which is attached with a lock nut on each side of the wood. The arm is pivoted to the wall by means of a U-iron as indicated, a strong spring being fastened to the arm and wall to hold the saddle at any desired height.

—Leo Abler, Mt. Calvary, Wis.

Metal Gauges on Ruler to Draw Equally Spaced Lines

Fastened to a ruler with thumbtacks, two pieces of thin sheet metal, cut to the shape shown, will enable one to draw, rapidly, parallel lines that are equally spaced.



Parallel lines are equally spaced and have a uniform margin at the left when using these gauges

The points of the gauges are always put on the edge of the last line drawn so that the ruler will be in position for the next one. Notice that the gauge on the left end of the ruler has two points, one in line with the extreme end of the ruler so that the user can start ruling directly below the preceding ones, and thus leave a uniform margin. The other point is set on the line. Of course, one point can serve both purposes.—John G. Roberts, Chicago.

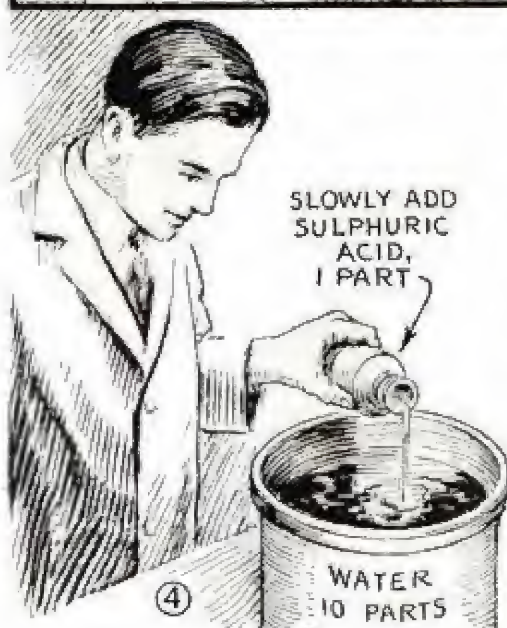
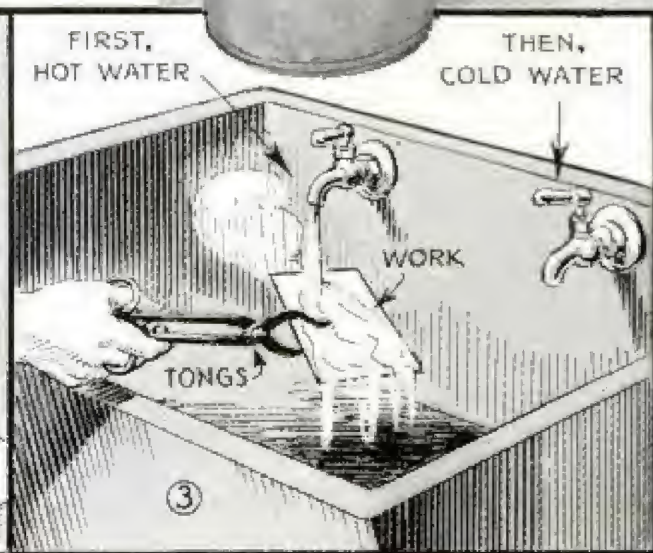
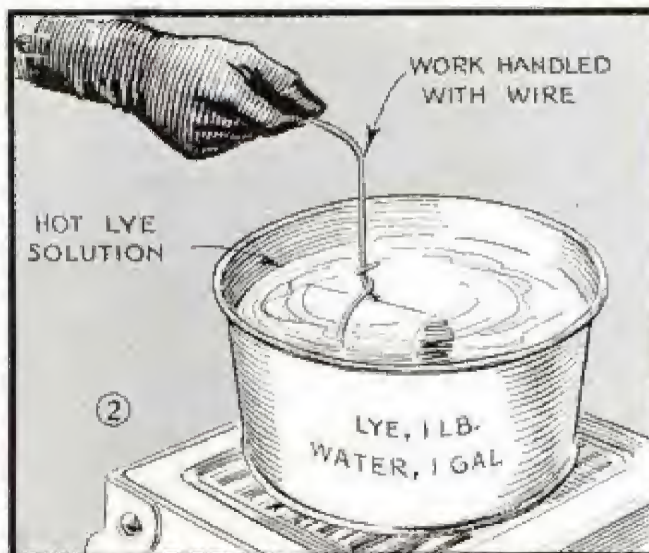
METALS IN COLOR

Chemical Coloring of Iron, Copper, Aluminum and Alloys

By C. A. CROWLEY

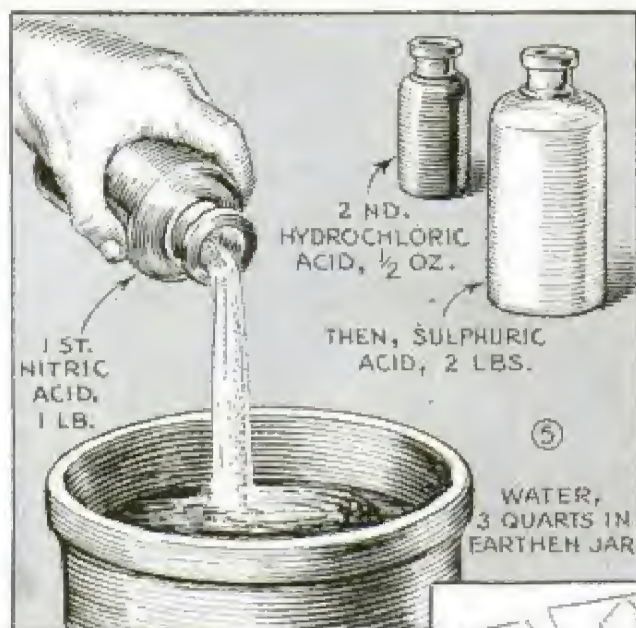
METALS are enhanced in beauty, rendered less susceptible to atmospheric corrosion and made more serviceable by applying suitable coloring methods, which can be cheaply and easily carried out by anyone.

Cleaning Before Coloring: In order to secure a durable, adherent finish on metal, the surface to be colored must be scrupulously clean. All grease, dirt, rust and corrosion must be removed. If the article is iron, steel, brass, or copper, first scrub the



surface with a hot solution of a good washing powder, as shown in Fig. 1. Next dip the article into a hot solution consisting of lye, 1 lb., in water, 1 gal., as in Fig. 2, to remove all traces of grease. After each washing, rinse the article thoroughly first in hot water (preferably running) as in Fig. 3, and then in cold water. The article must not be touched again with the hands. Handle the work with wires or clean tongs and wear rubber gloves.

Pickling Iron and Steel: Following the cleaning, iron and steel must be pickled to remove rust and scale. The pickling solution is made by adding sulphuric acid, 1 part by volume, to water, 10 parts by volume. Slowly add the acid to the water in a stone crock as in Fig. 4. Then the work is dipped into the solution, perhaps several times, rinsing and scouring between dips and letting the article



remain in the solution for a few minutes each time. When all corrosion has disappeared and the surface is clean and bright, the article is removed from the pickling bath and rinsed in hot and then in cold water. It should not be handled with the hands or left exposed to the air.

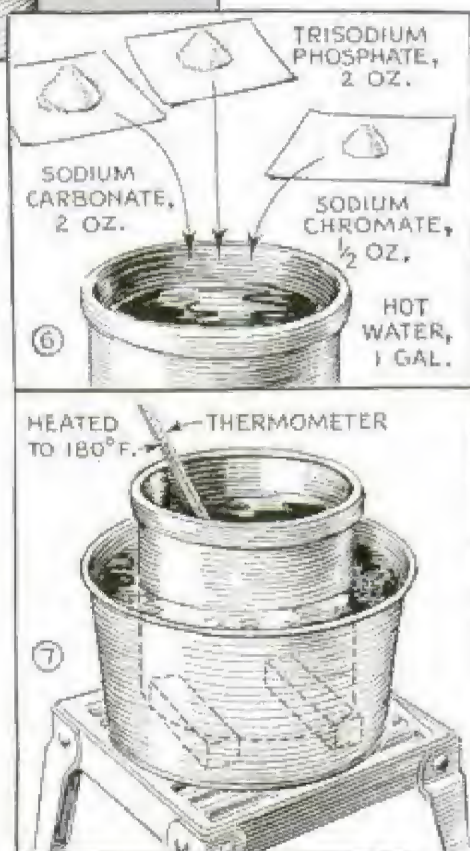
Bright Dipping: Copper and brass may not require treatment other than the washing powder and lye cleaning to remove grease. If corrosion is present, it, however, must be removed with a bright dip. This is made by adding nitric acid, 1 lb., and hydrochloric acid, ½ oz., to water, 3 qts., and then adding sulphuric acid, 2 lbs., Fig. 5. The mixing should be done in a stone jar. The article is dipped into the cool solution, quickly removed, and thoroughly rinsed in hot and then in cold water. It must not be allowed to remain in the solution.

Cleaning Aluminum: The methods already given for iron, steel, brass and copper are not applicable to aluminum and therefore must not be used on this metal or on aluminum alloys. To remove grease from aluminum and aluminum alloys, an alkaline cleaner can be made by dissolv-

ing sodium carbonate, 2 oz., trisodium phosphate, 2 oz., and sodium chromate, ½ oz., in water, 1 gal., as shown in Fig. 6. This solution is heated to 180° F. in a stoneware vessel as shown in Fig. 7 and the work immersed for 3 or 4 min. Next, an acid rinse is used to remove all traces of the alkaline bath and to dissolve the oxide film which is always present on aluminum. To prepare this, add 50 per cent hydrofluoric acid, 1 part by volume, to water, 9 parts by volume, in a lead-lined container, as shown in Fig. 8. Do not use glass or stoneware. This acid must be handled with great care as it produces

severe burns on the skin which heal slowly. Dip the aluminum article in this solution from ½ to 1 min., then rinse thoroughly in cold water and suspend under water until ready to color it.

Coloring Copper and Brass: Black can be produced on either copper or brass with a solution made from ammonium molybdate, ½ oz., and sodium hyposulphite ("hypo"), ½ oz., dissolved in water, 1 qt., as in Fig.



10. The solution is heated almost to boiling, and the clean metal article immersed. It should be left in the dip for from 15 min. to half an hour. Following the coloring bath, the object is rinsed thoroughly and allowed to dry.

Various shades of brown are produced on copper and brass with the following solutions. The color produced depends on the time the article is left in the solution, and also is different for copper and brass. Dissolve potassium permanganate, 1 oz., and copper sulphate, 8 oz., in water, 1 gal. Warm the solution to 100 or 110° F. and introduce the object, for 20 min. to a half hour. This solution colors brass a darker brown than it does copper and so for corresponding shades the immersion time for brass will be shorter. A similar solution is made from potassium chlorate, 2 oz., copper sulphate, 4 oz., and water, 1 qt. Warm the solution a little and let the objects remain in it for 5 or 10 min. Copper will be colored a reddish brown; brass, a drab brown.

Bluing Process: Rich, deep blues can be produced on copper and brass by a method which also can be applied to iron or steel. Make up a solution of sodium hy-



AMMONIUM
MOLYBDATE } 1/2 OZ.
SODIUM
HYPOSULPHITE } 1/2 OZ.
WATER
1 QUART

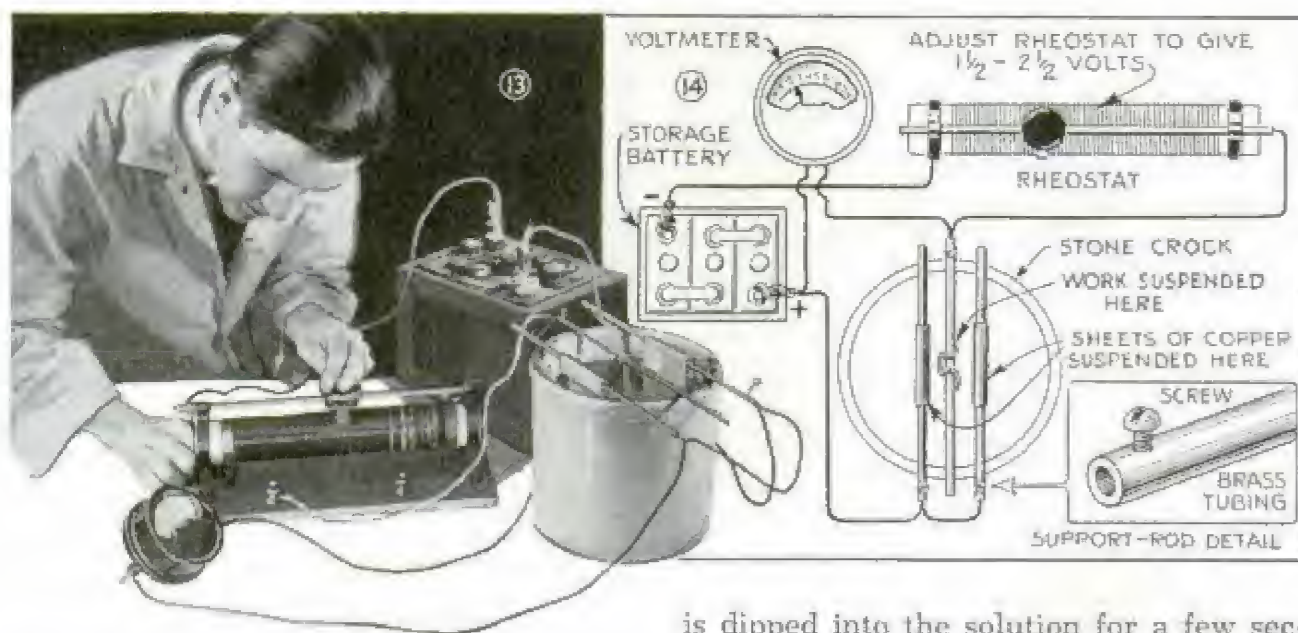


posulphite ("hypo"), 4 1/2 oz., lead acetate, 1 1/2 oz., in water, 1 qt. Heat the solution to 180 or 190° F., and dip the thoroughly cleaned metal article in the solution, as in Fig. 12. The intensity of the color depends upon the duration of the dipping. Copper and brass will be colored a dark, rich blue in from 2 to 5 min. A steel-blue will develop on iron or steel in about 5 min. The objects may be removed periodically to see if the color is satisfactory. Steel objects such as gun parts, Fig. 11, are blued in this way. However, before dipping gun parts,

it is advisable to practice on scrap pieces of polished steel until thoroughly familiar with the action of the chemical.

Red Color on Copper: Copper is colored red by immersion for 5 to 10 min. in molten sodium nitrite. The salt may be melted in a clean iron kettle or pot. Be sure that it is not soldered. As the molten salt is very hot, it is imperative that the metal object to be colored be thoroughly dry





before it is dipped in the hot melt, or the hot salt may spatter and burn the operator. The ideal procedure for this and other molten salt processes is to remove the object from the alkaline rinse or bright dip, thoroughly rinse in water, shake to remove most of the water, and dry for a few minutes in an oven at 225° F. When dry, it is dipped into the molten salt, until the desired color is attained. The article is then allowed to cool, after which it is rinsed with water to remove adhering salt.

Violet on Copper: If 1 per cent of potassium permanganate is added to the sodium-nitrite bath, the copper will be colored a beautiful violet instead of red. The sodium nitrite and potassium permanganate are mixed before melting. The violet color will appear on the article within 5 min. and deepen slowly with longer immersion. If the salt is to be used again, let the kettle and its contents cool. It can be put away until the next time it is needed. If it will not be used again, it is advisable to pour the molten salt into a pail containing dry sand as in Fig. 9, in order to dispose of it safely.

Gray on Copper: Copper or brass can be colored gray by plating with metallic arsenic. To prepare the plating solution, dissolve ferrous sulphate, 3½ oz., and arsenic trioxide ("white arsenic"), 3¼ oz., in concentrated hydrochloric acid, 2 lb., in a stoneware jar. This solution is very caustic, and arsenic trioxide is a deadly poison and therefore this solution must be handled with great care. The clean article

is dipped into the solution for a few seconds only. It is then removed and rinsed. If the desired gray has not been obtained, dip the article again for a few seconds. As this solution works very rapidly, it is not advisable to leave the metal in it for more than a few seconds.

Green on Brass or Copper: There are a number of methods for producing green surfaces on brass and copper. A "patina" which closely imitates the natural green finish produced on copper by long weathering, may be obtained with a solution consisting of a saturated solution of copper nitrate, 1 fl. oz., ammonium chloride, ½ oz., and 10 oz. of 20 per cent acetic acid. To make 20 per cent acetic acid, add to glacial acetic acid, 1 lb. 11 oz., enough water to make the total volume of one gal. This solution should be brushed on the surface with a rubber-set brush, and allowed to dry. Several coats should be applied at intervals of two or three days until the desired shade of green is obtained.

Hardware Green Finish: The hardware green finish popularly used on brass can be obtained by dissolving sodium hypsulphite, 8 oz., and ferric nitrate, 2 oz., in hot water, 1 gal. The solution is heated to 180° F. and the brass object immersed until the green color appears.

An antique verde finish on either copper or brass is prepared by brushing on the surface a solution made up of copper nitrate, 4 oz., ammonium chloride, 4 oz., and calcium chloride, 4 oz., dissolved in water, 1 gal. The solution can be brushed on the surface, using a rubber-set brush or a sponge, and stippled. Or, the article may

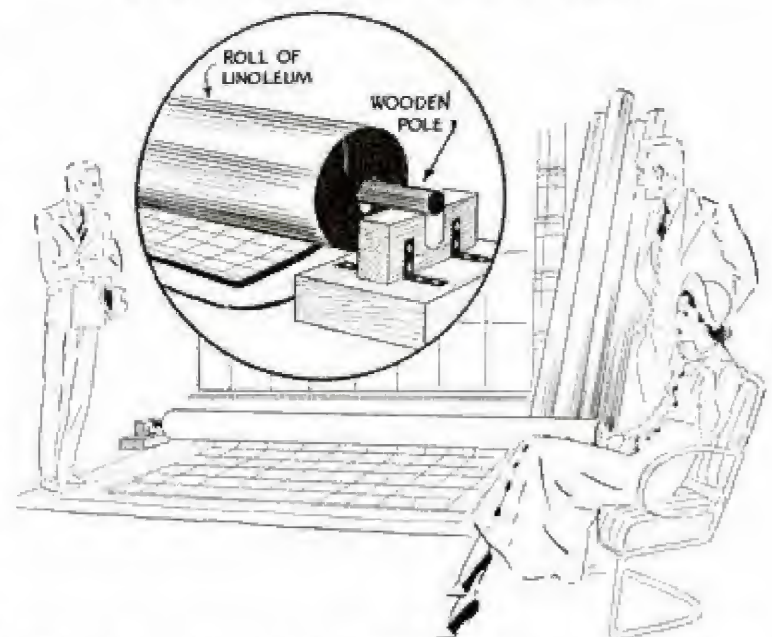
be dipped in the solution for a few minutes. The article should be rinsed thoroughly, allowed to dry, and then lacquered to protect the finish.

Coloring Iron and Steel: There are comparatively few colors that can be produced on iron, steel, or aluminum direct; however, all the colors that can be applied to copper can be made applicable to these and other metals if they are first plated with copper. The article can be electroplated with copper in the usual manner, or if preferred, a thin copper plate can be produced by dipping. To produce a dip plate of copper on iron or steel, dissolve copper sulphate, 2 oz., in water, 1 pt. In another container dissolve tartaric acid, 1 oz., and sodium hydroxide, 1 oz., in water, 1 pt. The two solutions are not to be mixed until you are ready to use them, as the mixed solution will not keep. Thoroughly clean the article and rinse it. Mix equal parts of the two solutions in a stoneware or glass container, and dip the article in the mixed solution. Let it remain for a few minutes, after which the article is rinsed in hot and then cold water, and allowed to dry. The copper surface may be colored by any of the methods previously described.

Electroplating with Copper Before Coloring: In cases where it is desirable to produce an exceptionally adherent coating of color on iron, steel, aluminum, or other metals, the work should be copperplated with a solution consisting of water, 1 gal., to which is added copper sulphate, 2 oz., then sodium oxalate, 1 oz. $2\frac{3}{4}$ drams, and finally triethanolamine, 3 fl. oz. The solution is mixed in a stoneware crock. Figs. 13 and 14 show the connections to be made between the battery rheostat and instruments for plating with this solution. After the plate has been effected to a thickness sufficient for the purpose at hand, the coloring of the metal may be carried out in precisely the same manner as was explained for copper or brass.

¶ An old umbrella with the cover removed and the ribs enameled provides a handy drying rack for small articles.

Linoleum on Roller Is Displayed Before Store Customer

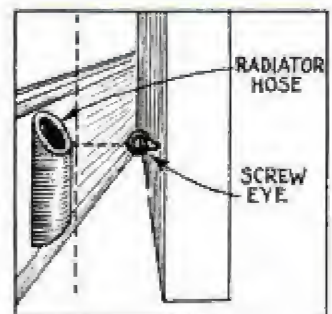


Unrolling many square feet of linoleum gives customer better idea of how it will appear in the home

Finding that a number of his customers were unable to decide on the pattern of linoleum they wanted by looking at a small portion of it in a roll, one storekeeper mounted the rolls so that they could be pulled out on the floor. This gave the customer a better idea of what the particular patterns would look like when placed on their floors. Strong wood blocks, assembled as shown in the detail, were placed under the ends of the center pole of each roll of linoleum

Doorstop from Piece of Tubing and a Screw Eye

Here's a combination doorstop and bumper that you can assemble for your shop door in a jiffy. Just take a piece of old radiator hose, cut off one end at an angle and nail it to the wall so that the beveled edge will engage the head of a large screw eye driven into the door. Locate the tubing so that the screw eye compresses the rubber as it slips over the edge.



Optician's Tools Neatly Arranged on Oval-Shaped Rack

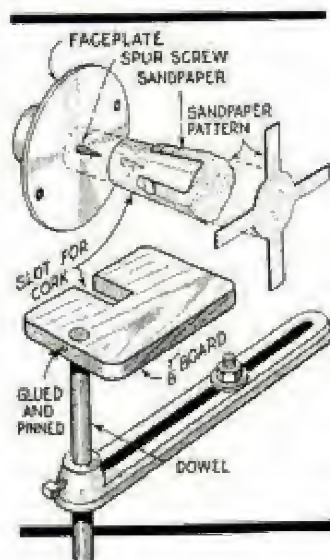


This rack keeps your tools in plain view so that you can pick out the one needed at a glance

Especially designed for use on an optical workbench, this rack is also handy for the jeweler or other craftsman who uses small tools. It holds pliers and similar tools, files, taps, screwdrivers, etc., so that any one can be picked out quickly. The rack is a piece of wood carved and sanded to the shape shown, and glued or screwed to a base.

—F. J. Pardinas, Vedado, Havana, Cuba.

Sander for the Modelmaker



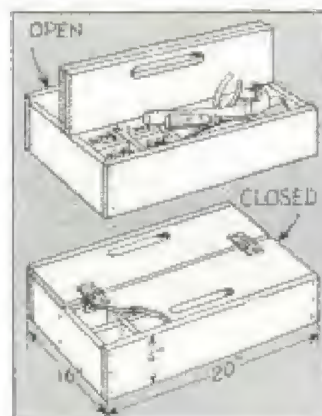
Modelmakers will find this power sander a time-saver as it is attached to the spur screw of a lathe. It consists of a cork with sandpaper attached as indicated, and any number of different sizes and grits can be made at little cost. A sander of the drum type can be made by

gluing the sandpaper to the sides of the cork. The sanding table shown in the lower detail is nothing more than a wood block fastened to a dowel, which is locked in the tool holder of the lathe.

—Charles Frerichs, Brooklyn, N. Y.

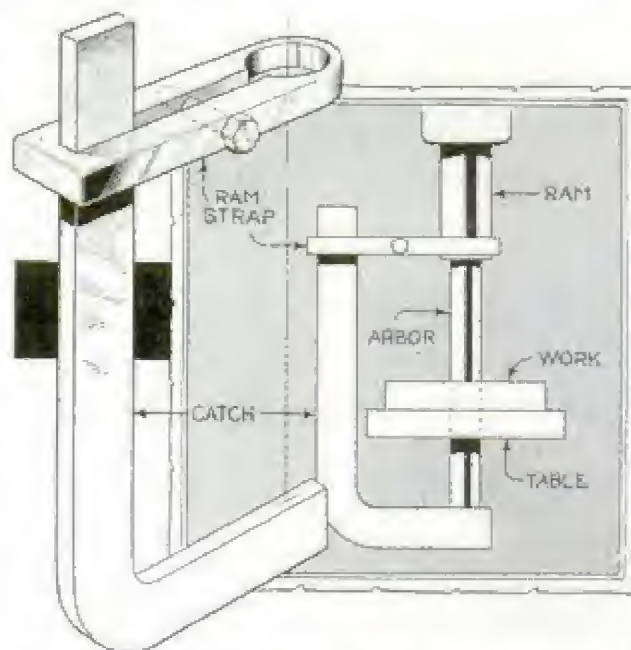
Toolbox Lid Folds to Provide Carrying Handle

This toolbox has a novel feature in that the lid is in two sections, which fold when opened to provide a carrying handle. The two sections are hinged individually to a center partition as indicated.



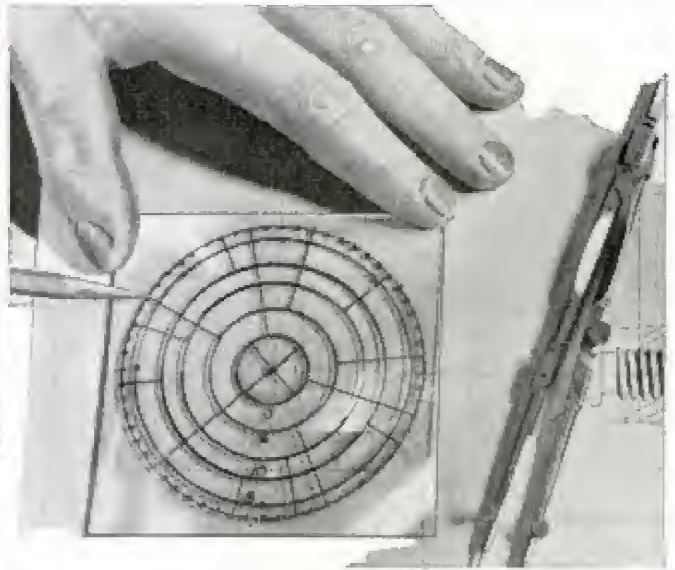
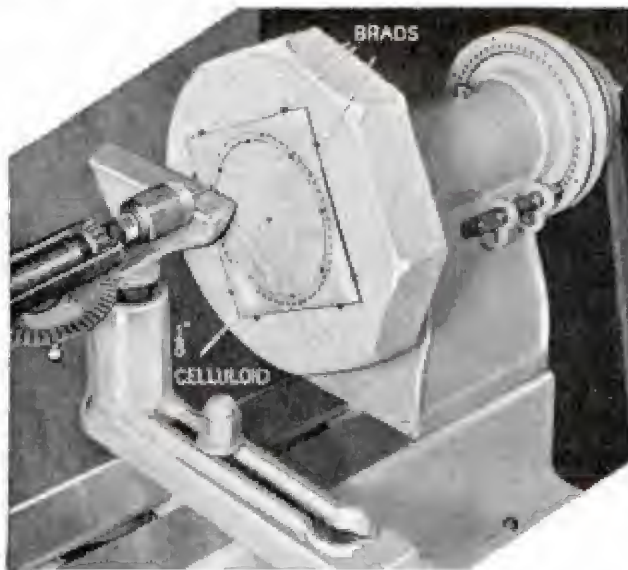
Adjustable Arbor Catcher

A feature of this arbor-catching device is that the catcher travels up and down with the ram. It is impossible for the arbor to fall and perhaps injure the center or the user's foot. The catcher is made in two parts, the strap that fits the ram and the catch that slides in it. This is adjustable to suit different arbors, and a single screw tightens both the catch and the strap on the ram.



Use this catcher on your arbor press and there will be little possibility of damaging the arbor

Circles Quickly Divided into Number of Parts



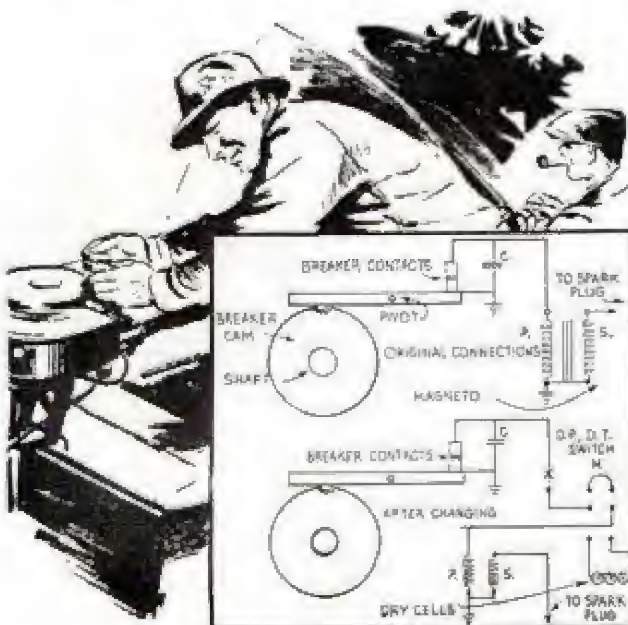
Draftsmen and others who often have to divide circles into a number of parts will find they can do the work quickly with this simple jig. It is made from a piece of celluloid 4 in. square which is fastened to a wood faceplate on a lathe and holes drilled through it, using the index head as shown. My divider has sixty holes in one circle and eight in the other. In use, the center of the jig is placed over the center of the circle and the desired divisions are marked. Lines drawn through these points and the center will give the divisions for any size circle. Circles may be scribed on the face of this jig with lines marked to the divisions most used.—Howard R. Heydorf, Missoula, Mont.

Extra Current to Start Engines Having Flywheel Magnetos

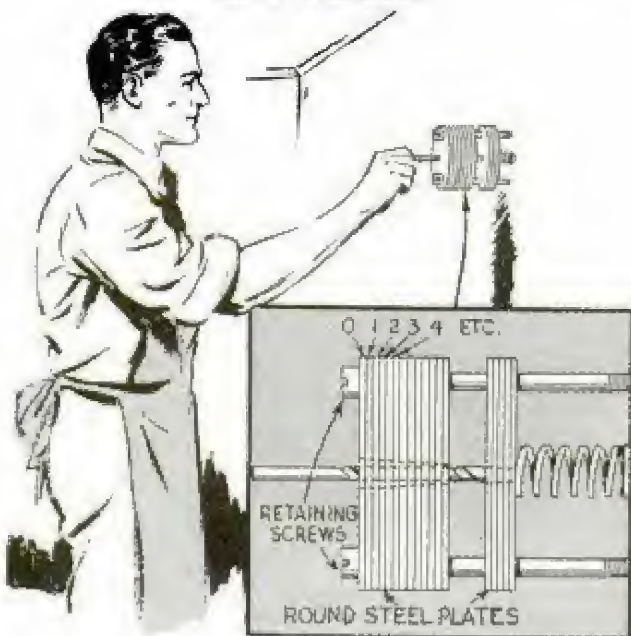
When you experience difficulty starting a small gasoline engine in which the magneto is contained in the flywheel, the trouble is probably caused by weakened magneto magnets, and usually can be eliminated by connecting a battery into the circuit to provide additional current for starting. Referring to the upper sketch, you'll notice that the breaker cam closes the con-

tacts when the arm point drops into the cam slot. The spark is obtained when the cam lifts the arm and breaks the contacts. The primary of the magneto is connected in series with the breaker contacts and grounded at one end together with one wire of the secondary side. As the flywheel rotates carrying the permanent magnets around with it, the contacts are broken, which produces a spark. To hook up the battery, the engine is dismantled so that the wiring to the magneto is visible. The wire from the primary leading to the breaker contacts is broken at the point marked X on the lower sketch and is connected to the center terminals of a double-pole, double-throw switch. The top terminals of the switch are connected together with a copper wire, and a storage battery or four No. 6 dry cells are connected to the lower terminals. To start the engine, the switch is thrown to the battery side, connecting the latter in series with the primary of the magneto, which produces greater voltage and enables quick starting. After the engine has warmed up, the switch is thrown to the magneto side.

—Edward Stanko, Medina, N. Y.



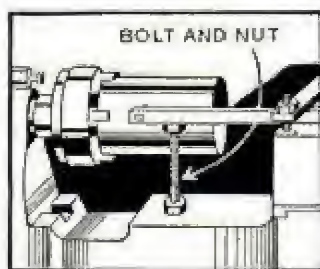
This Drill Gauge Shows the Size at a Glance



There is no chance of misreading sizes with this drill gauge because one figure is all you can see at a time

You can't make a mistake in drill sizes with this gauge because the drill is pushed into it and the correct size number is the only one you can see. The gauge consists of a number of steel disks or plates drilled near the edge to slip over two retaining screws, which are set into a bench or wall over a coil spring also set into the wall, the spring keeping the disks pressed against the screw heads. Before assembling, each disk is drilled in the center with the size of drill it is to indicate, using your largest drill on the first or front disk, the next size on the second disk and so on down to your smallest drill. Thus, a drill will pass through all the disks until it reaches one which has a hole one size smaller than the drill, when it will push the remaining disks toward the wall. Stamp the size of each drill on the disk it pushes back.—Edwin Rose, Chicago.

Long Tool Is Supported Rigidly When Turning Large Work

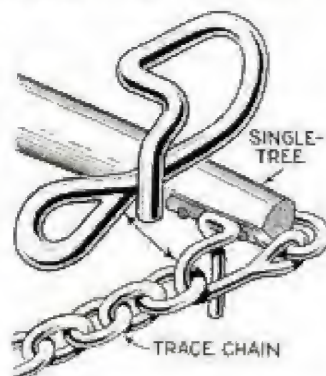


When turning work that is too large to allow the carriage to be moved close enough to use a regular tool holder, and a long ex-

tension bar must be used, the bar can be supported as indicated. A bolt with a nut is set vertically on the carriage or bed under the bar. This tends to make the bar rigid and eliminate chatter.

Harness Chain Traces Can't Drop from These Singletree Hooks

Difficulty in keeping harness chain traces from dropping out of the average singletree hooks is eliminated with the one shown. It is bent to shape from iron or steel rod, the eye end of the hook being welded to keep it from spreading under a heavy load.



—George Lynch, Jr., Crystal Spring, Pa.

Long Spout on Tube of Cement for Hard-to-Reach Places

When I get a tube of household cement, I cut off the spout from a 5-cent oilcan and solder it over the end of the tube as indicated. This enables me to apply cement in hard-to-reach places. When the cement is not in use, a brad or tack inserted in the end of the spout keeps out air. After the contents of the tube have been used, the spout can be removed, by heating, and soldered to a new tube.

—Kenneth Murray, Sturgis, Mich.



Long spout soldered to tube of cement to get at hard-to-reach places around the home

*Johnston Tinfol and Metal Co
400 W. Madison, Chicago
Reynolds Metal Co
400 N. Michigan
Chicago*

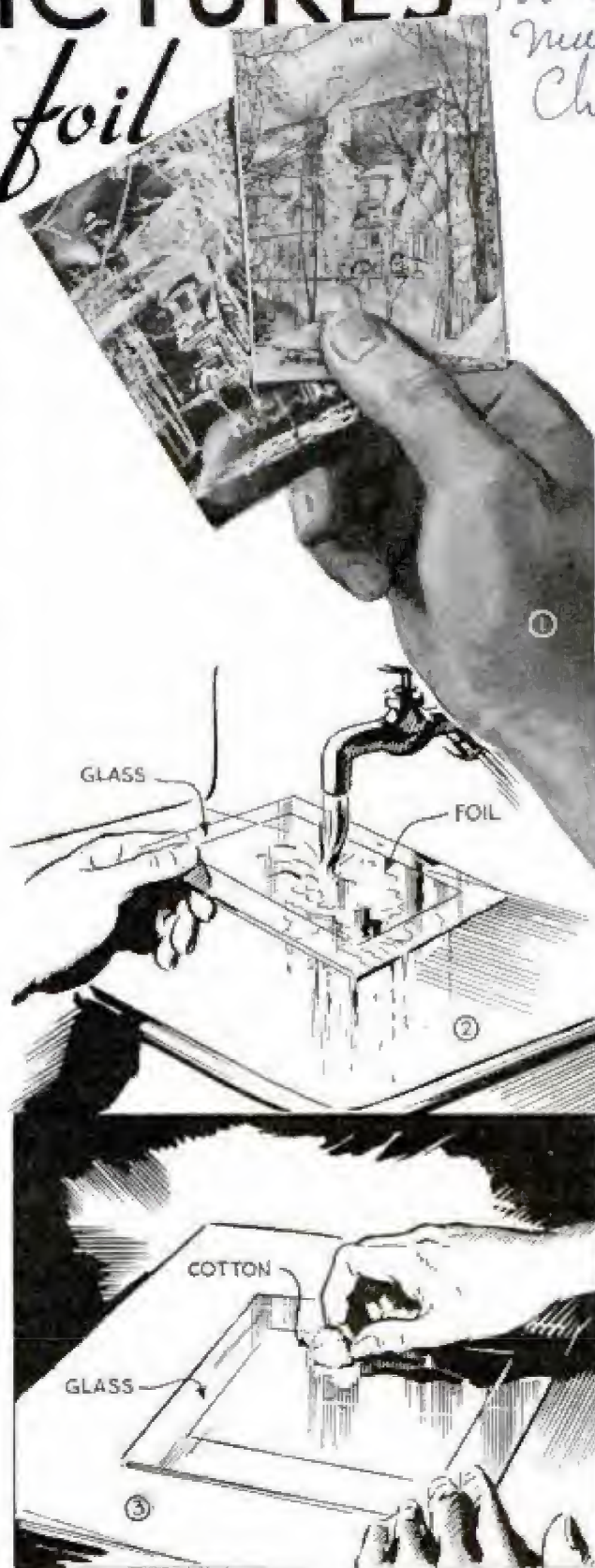
PRINTING PICTURES *on aluminum foil*

By James G. Zimmerman

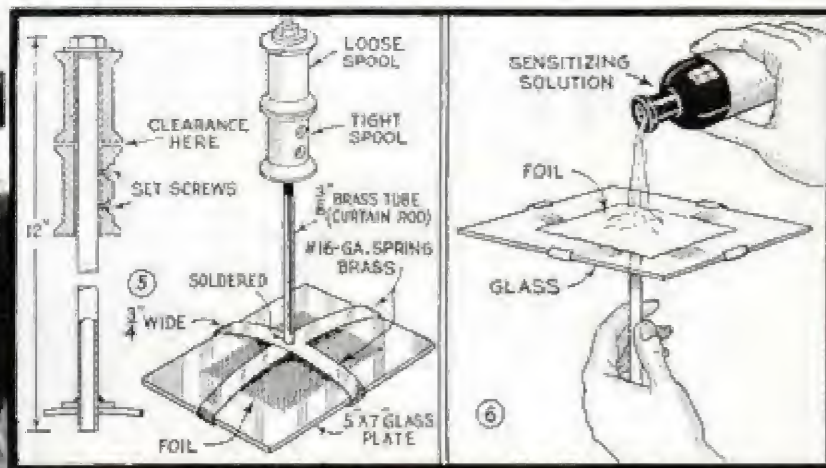
THIS simple process offers possibilities for novel personal treatment of holiday/greeting cards, besides making color prints of your favorite negatives on metal foil instead of on the ordinary printing papers. As you will see from Fig. 1, the finished prints appear much like hand-wrought etchings with the added variety of color.

The first step is a thorough cleaning of the foil. To secure a good surface for the sensitized coat to follow, the foil is laid flat upon the larger glass plate after being sure that there is no dirt between the foil and glass, Fig. 2. A good way to be sure of this is to hold the glass under running water while applying the foil. The water will wash away dirt and will allow the foil to rest on the glass with a wet surface between. Drain and then lay flat. Polish the foil vigorously with a tuft of cotton and whiting by holding the foil with the edge and rubbing away from the fingers holding it down, Fig. 3. Repeat in all directions holding at different edges. The foil will gradually take on a silvery finish of a matte nature. This is the grain that is wanted to act as a hold-down for the sensitized film. Give a good rinsing while rubbing lightly with a clean cotton tuft.

An arrangement for whirling the foil dry is shown in Figs. 4 and 5. It consists of two large spools and a piece of hollow brass curtain-rod tube with two $\frac{3}{4}$ -in. wide No. 16 gauge brass strips. The rod is of $\frac{3}{8}$ -in. diameter and fits the spool bore. One spool is loose to allow of turning the rod in it and the other is fastened to it either by screws or glue. The upper loose spool serves as a handle and the lower one is caused to turn by spinning it with the other hand. The two brass strips are made of sufficient length to take the plate used. For example, an old 5 by 7-in. glass plate is convenient. The strips are placed at



right angles and drilled with a $\frac{3}{8}$ -in. hole at their corners. Then these strips are soldered to the tube and bent into a part circle or arc and the tips bent to take the glass with a small overlap. A washer is



soldered above the top spool to act as a thrust bearing against the spool head where a flat metal washer is placed to make a bearing which may be lubricated. After applying the foil of aluminum on the glass plate by simply wetting the surfaces and draining sideways, the glass is sprung into the clips with the film faced outward or downward. When the spool is rotated, the plate whirls with it. Hold the upper spool in one hand and whirl with the other hand.

Next, you prepare the sensitizing solution. Beat the whites of two eggs to a very stiff froth in a bowl as in Fig. 10, and set aside for about four hours. The froth will give up a liquid which settles to the bottom of the bowl. Pour out this liquid without disturbing the froth, and mix it with the same quantity of clean water, preferably boiled and cooled. Add about 4 grams of ammonium dichromate (or potassium dichromate) and dissolve it. This will give a reddish yellow fluid. Now, very carefully, add ammonia, drop by drop (ordinary household ammonia will do), and watch the solution after each drop is thoroughly mixed in. It will gradually turn to a lemon yellow. Then it is ready for use. Filter the solution through a cotton wad in a funnel. Wet the wad and then use, otherwise it will not work well. The filtered solution is now ready to use on the plate in the whirler.

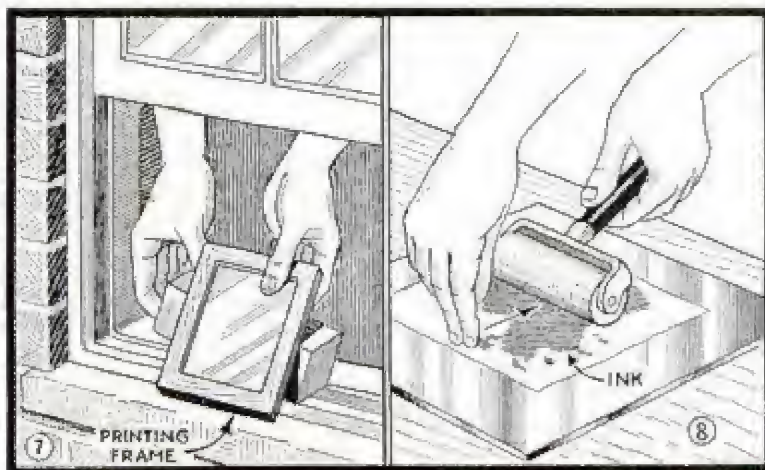
Hold the foil under the tap to wet it,

then whirl until all the free water is thrown off. Turn the whole thing upside down and hold it as in Fig. 6. Pour onto the foil a small quantity of the sensitizing fluid and tip it slowly in all directions to make the fluid flow to the edges of the foil and so cover it entirely with a thin coat. Continue the tipping for a few minutes, drain off at one corner, and then whirl to throw off any excess. Apply a second coat in the same manner as before. This time it will be noted that the fluid is more tacky than it was. Whirl at about 50 r.p.m. over a heater to dry the coat. Be very careful not to heat higher than can be stood by the hand. Try this before coating until the proper distance from the heater is found. When dry the foil is ready for printing. Remove with a penknife and clean the back of moisture.

Keep the foil dry and print in the usual printing frame under a vigorous negative. If you have no arc light, print in the sunlight, Fig. 7. It requires experience to know just when to stop printing but if the negative is very contrasty this is not so important. In full sunlight it will take about 5 min., and 1 ft. from a 10 amp. arc light it will take 2 to 10 min. A good way is to take a coated foil without any negative and print by steps, giving the print exposures of 2, 4, 6, 8 and 10 min. by holding a mask over the frame and advancing it a space at a time. Then proceed with the inking up and find which exposure is best for clear open spaces on a negative. An experiment with a negative will show the proper exposure. Label the negative with the proper exposure for future use.

To ink the print, place it, face up, on a dry piece of glass. Now, on another glass plate roll up a pea-sized drop of printers'

A. Langley & Co., 159 W. Morgan, Chicago

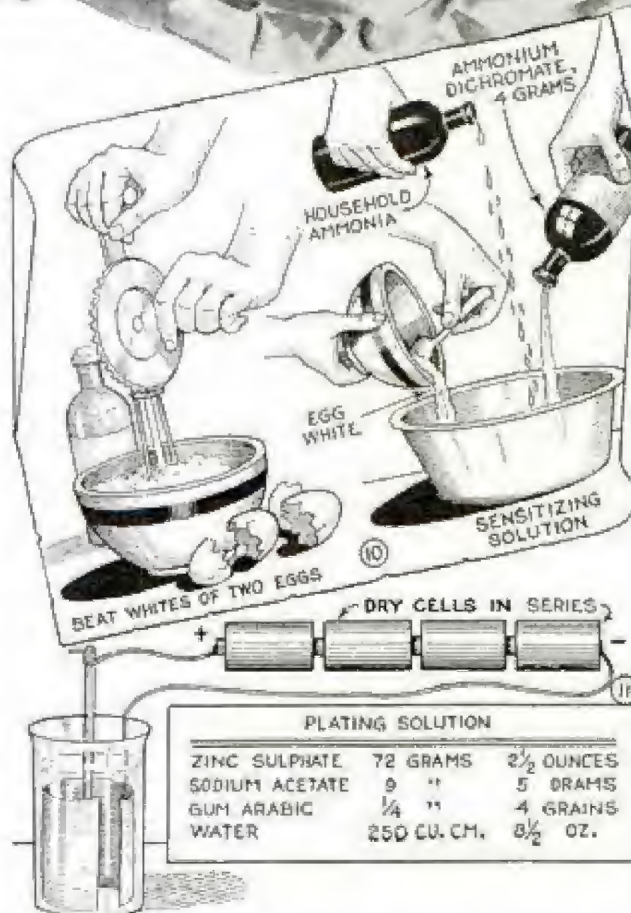


ink until the roller is evenly coated and the plate evenly spread. It is necessary that the ink be not too sticky or when rolling the print the foil will stick to the roller. It is best to start with a rather slippery ink and add a drop of kerosene or linseed oil. Now, holding the foil with the edge by a finger, roll away from the finger and repeat in the opposite direction, holding at the other edge, Fig. 8. After a number of rollings the ink will become darker.

Take the glass plate and foil together and immerse into a deep tray of water, Fig. 9. Do not touch the surface with the fingers at any time. Leave under water a few minutes. The picture will at once begin to show and after the proper time lift the plate out with the foil on it. Wet a tuft of cotton and while the print is under water or under the tap lightly rub the surface. The surplus ink will immediately rub off, leaving the print in full detail. Be careful not to rub too strongly, especially at first, in order not to destroy any detail. If the exposure was too long the ink will adhere more strongly and will require more vigorous rubbing.

If it is desired to add color to the ink this may be done by first whirling the foil to dry it. Then the plate and print are cleared of all water or dampness by letting stand on edge or going over it with a damp cotton, lightly touching any damp spots. When dry the ink is still tacky and will take on any powdered color which is simply sprinkled lightly over the surface and dusted with a camel's-hair brush.

As aluminum foil is rather shiny it's a good idea to plate the print with a thin coat of zinc. The plating solution, Fig. 11, is easily made and keeps well. To dissolve gum arabic, first pulverize it in a mortar



| PLATING SOLUTION | | | |
|------------------|-------------|-----------|--|
| ZINC SULPHATE | 72 GRAMS | 2½ OUNCES | |
| SODIUM ACETATE | 9 " | 5 GRAMS | |
| GUM ARABIC | ¼ " | 4 GRAINS | |
| WATER | 250 CU. CM. | 8½ OZ. | |

and work it into solution with a little water. To plate, proceed as in Fig. 11. Wrap the finished print around a bottle or other cylinder with the printed face turned inwards. Then pour in the solution up to the top edge of the foil and finally hold the zinc strip in the center. The zinc plates only where the foil is exposed.

As the foil is not rigid it must be mounted on a firm backing like a photo mount. The print must be fastened to the mount with glue, as paste is not satisfactory.

False Bottom in Trailer Cabinet to Store Valuables



Compartment is opened by raising false bottom with wire inserted through tiny hole in real bottom

To provide a secret hiding place in his trailer for valuables, one owner hit on the idea of putting a false bottom in a wall cabinet as indicated. The false bottom was hinged at the back and was lifted with a small wire pushed through a tiny hole in the regular bottom. Care should be taken to finish the false bottom the same as the remainder of the cabinet, and the edges of the parts should be sanded to a close fit.

Storage Batteries Dismantled with Aid of Heat Gun



One use for a heat gun during summer months, when it is not needed for removing stiff grease from differentials and transmissions, is the softening of the compound on storage-battery tops in prepara-

tion for dismantling. This method requires less care than the flame method and is less likely to cause damage to the connectors or hard-rubber tops. In using the gun, the battery is placed in a closed box, similar to a steam box used by some shops for this purpose. The box has a hole in the center of the top for inserting the nozzle of the gun.—W. C. Wilhite, Carlinville, Ill.

Emery Strop for Knives

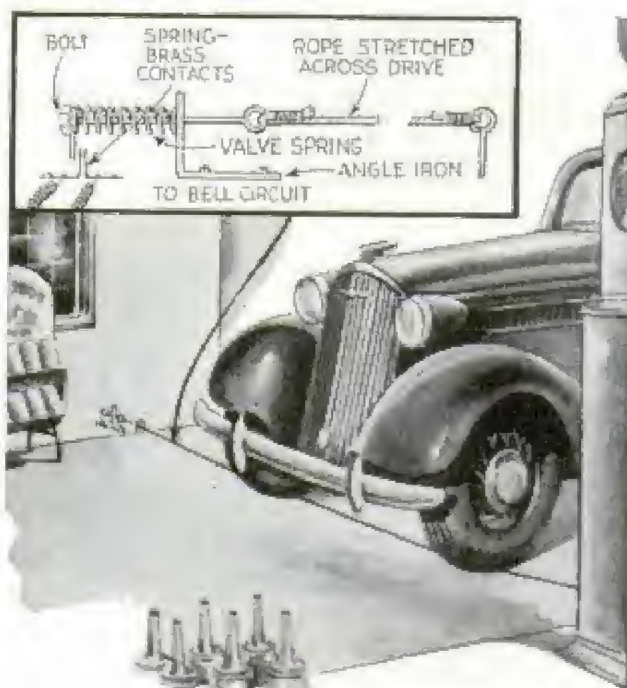
Knives for cutting rubber or fabric, when repairing tires and tubes, can be kept sharp by frequent use of an emery strop fastened to the workbench within easy reach.

The strop consists simply of a strip of fine emery cloth about two inches wide.



Alarm Warns Station Attendant When Car Drives In

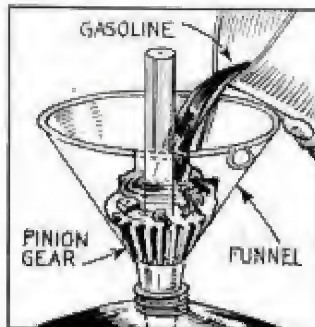
Here's a simple alarm for a filling station that requires no elaborate mechanism, compressed air, hose or anti-freeze solution—just a length of rope stretched about an inch above the drive so that the car



Car driving into filling station passes over rope, which closes circuit to electric bell

wheels pass over it. The rope is attached to a slender eye bolt, which passes through a metal bracket at one side of the drive or inside the station. A coil spring held on the bolt keeps the rope taut, while a small arm presses two spring contacts together when the rope is depressed.

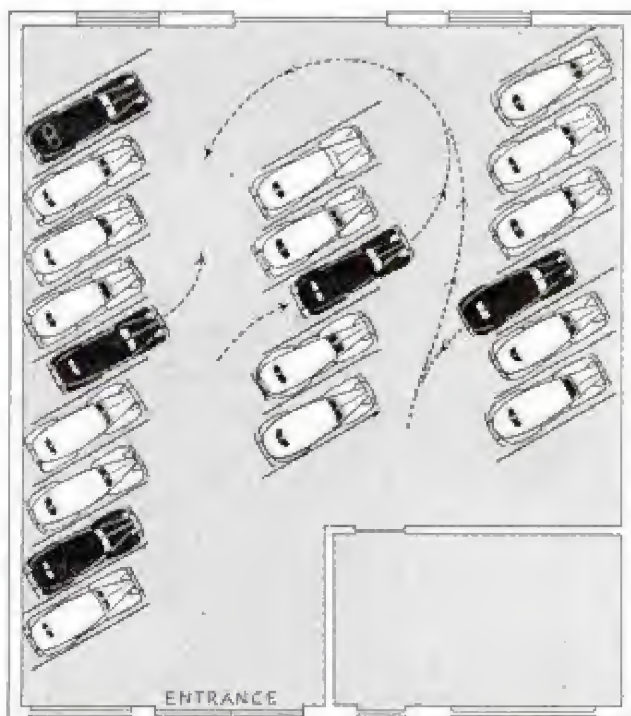
Gear Forms Funnel Strainer



While looking for something to strain gasoline used in washing small parts in a garage, a mechanic picked up a differential pinion gear and set it in the funnel as shown. The gear restricted the passage of gas very little, yet caught nuts, screws, bolts, washers and other small parts.

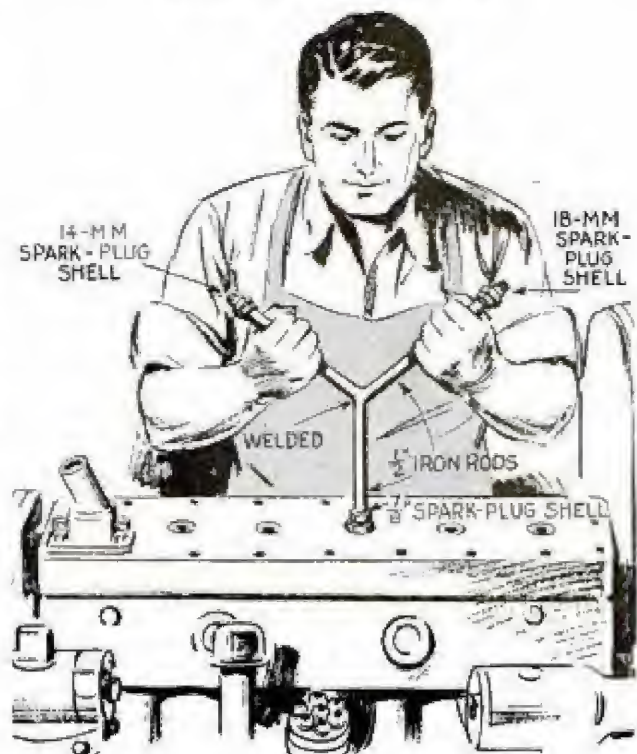
Cars Parked in Garage at Angle Driven Out Easily

Instead of parking cars at right angles to the walls of his garage, one owner parks them at an angle, leaving wide aisles between the rows as shown. Any car can be driven out as indicated by the arrows.



When cars are parked at an angle you can drive out without jockeying them into an aisle

Three-Way Tool Removes Heads from Car Motors



If you work on several different makes of cars, this head-lifting tool will be found handy

Improving on the old idea of welding a length of rod to a spark-plug shell to lift a heavy cylinder head, one mechanic who had to work on practically all makes of cars made this one, which has three shells of different sizes as indicated. When lifting a head, the two free ends of the tool provide good grips for the hands.

Car-Door Lock Is Lubricated with Insect-Powder Blower

If the lock on your car door works hard, try lubricating it with finely powdered graphite. This can be blown into the lock mechanism with an ordinary insect-powder

blower of the type shown in the photo, directing the powder through the key slot.



Ⓢ A dry, light-colored soot on spark plugs is an indication that the fuel mixture is too lean, while a dry, black covering of soot means that the mixture is too rich.

Windshield Wiper on Test Bench Operated by Vacuum Cleaner



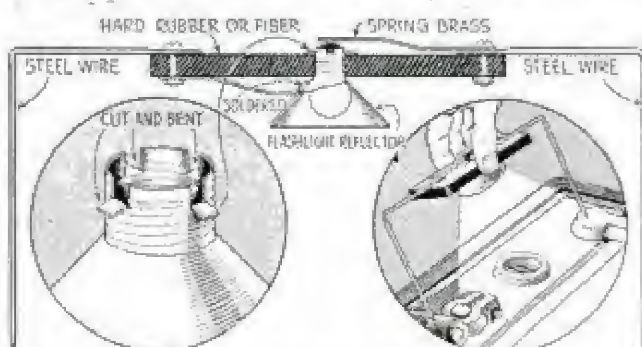
When you want to check the operation of the wiper on the bench, just turn on the vacuum cleaner

A simple method of operating a vacuum-type windshield wiper, while overhauling it on a bench, is to utilize the suction of a vacuum cleaner. The attachment hose of the cleaner is used, and the open end is provided with a tight-fitting wood plug inside a rubber sleeve. The plug is drilled and a short piece of tubing is forced into the hole to serve as a nipple to take the hose from the wiper.

—W. C. Wilhite, Carlinville, Ill.

Handy Lamp for Examining Cells of Storage Battery

Operated by current from the cell under examination, this small lamp illuminates the interior of a storage battery when checking the water level or appearance of the plates in a dark garage where

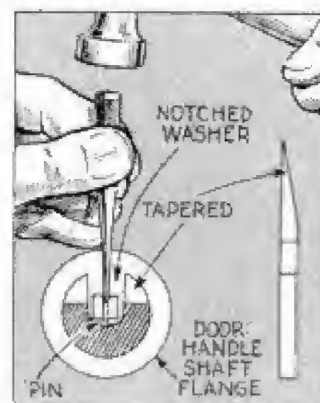


Press the prods against the terminals of the cell and the lamp will throw light into it

an extension lamp is unavailable. The lamp consists of a flashlight reflector, a 2.5-volt lamp, a piece of fiber or hard rubber, a strip of spring brass and two steel-wire prods assembled as shown. The distance between the prod points is the same as that between terminals of a cell.

Inside Door Handles Removed with Aid of Washer

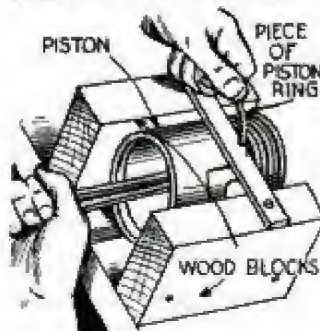
A slotted washer greatly simplifies the job of removing door and window regulator handles of the type that are pinned to the shaft. In use, push the washer over the shaft between the handle and flange covering the upholstery.



This will expose the pin, which can be driven out with a small punch, the pin removing the washer as it comes out of the shaft. Repeat the operation to replace the pin, and then tap the washer lightly with the hammer to remove it.

—Emil J. Novak, Omaha, Nebr.

Jig to Clean Piston-Ring Grooves



For an inexpensive method of cleaning carbon from piston-ring grooves, try this simple jig. Lay the piston on a bench, nail wood blocks on each side of it and fasten a piece of flat iron across them, first making a hole in the iron to take the end of a broken piston ring. Then, holding the end of the ring firmly in the hole, push it into the ring groove and turn the piston.

—Cyril J. Weyrauch, Ray, N. D.

ⓘ When replacing a gasket on your car, be sure that the surfaces of all parts are clean; but do not clean so vigorously that bits of the metal are removed, as this may cause leaks.



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STEEL MILLS, lumber camps, dams, skyscrapers, coal mines, subways (*as above*) — appeal to Margaret Bourke-White. Heedless of toil and hazard, she has gone all over the United States, up under the Arctic Circle, into far countries. And her photographs are now internationally famous for their vigor and sensational interest. *They're different!* And that's the same remark that Miss Bourke-White made about Camels to Ralph Martin at the New York World's Fair grounds (*right*).

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ONE SMOKER
TELLS ANOTHER

"CAMELS"

SHE COMBS THE WORLD FOR PICTURES THAT THRILL

What Margaret Bourke-White, famous photographer, said when Ralph Martin asked if she found a difference in cigarettes



"Cigarettes seem pretty much alike to me. Do you find some difference between Camels and the others, Miss Bourke-White?"

"I've found that Camels are very different, Mr. Martin—not just in one way, but in a *lot* of ways. For example, my nerves must be just as trustworthy as a steeple jack's. Camels don't jangle my nerves. They taste extra-mild and delicate too. Camels never leave an unpleasant after-taste, and they're so gentle to the throat. In fact, I can say Camels *agree* with me in every way! I think that's what counts most—how your cigarette *agrees* with you!"

Camels are a matchless blend of finer, MORE EXPENSIVE TOBACCOS — Turkish and Domestic

AGREE WITH ME"

Nature Photos in Your Own Yard

(Continued from page 885)

For these reasons, it is a good rule to snap your "close-up" pictures at a distance which will allow a safe margin around your subject without making the image of the subject too small. Any surplus margin



Ducklings are hardly "wild life," but these youngsters have a camera personality all their own

can be masked out when you enlarge the picture.

For "close-ups" of small objects such as butterflies, spiders and other insects, you can use a title-making device of the type used by makers of home movies. With your camera set at infinity and mounted so that its lens is directly behind the titler lens, you can snap anything that appears in the front title frame. In fact, you can use a larger frame than the one on the titler, because your still camera lens has a wider "angle of view" than the movie camera lens.

The title device is useful because it simplifies focusing. Anything surrounded by the title frame is automatically in sharp focus. If your camera lens is larger than the titler lens, it is necessary to "stop down" the camera lens to an opening smaller than that of titler lens. This, however, is no bother, because in snapshots of this sort you want to use as small a lens opening as light permits, to obtain added "depth of field."

When doing nature pictures, don't overlook the possibilities in inanimate things—buds, tree blossoms, moss and lichens on stones, flowers both wild and garden. When seeking these things, it is a good idea to carry small sheets of white, gray and black cardboard or cloth, which provide splendid backgrounds. Spotty, confusing

backgrounds should be avoided in nature pictures just as in pictures of people.

Bear in mind, too, that there are many nature subjects which you can picture at home much better than in the field. Most nature photographers carry small boxes or bottles on their trips into the country, so that if light conditions do not permit snapping a small subject in its natural habitat, they can catch it and take it home. There, they pose it under lighting arranged to show its characteristic features to best advantage. When you take a subject home, you can take along materials from its habitat, and arrange natural setting.

The home aquarium is another source of interesting pictures. It must be rectangular, preferably with growing water plants. In making aquarium pictures, arrange a sheet of clean glass in the tank near the front so that the fish are restricted to a space about an inch wide. This keeps them from swimming out of range after you focus, and they also show up more clearly because there is little water between them and the lens.

The wise beginner in nature photography will not overlook the picture possibil-



Sometimes a large bird's nest is photographed more effectively from a distance to show surroundings

ities in zoos, or in western parks on vacation trips. He may not find "nature in the raw" at the zoo—but he will find many interesting pictures, and gain much experience that he can use in the field.

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TO BE
SO WIDELY
IMITATED



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Dress Up Your Magic Tricks

(Continued from page 893)

agree and with no inner tube handy you proceed to prove your point with a piece of rope. Holding it so it makes a complete circle you win the argument by tying a knot in the center. Holding the rope by the extreme ends, you go through the movements of tying a knot. When the hands are drawn apart there is a loop around the right end of the rope. The hands are turned over, the fingers of the right hand quickly release the end of the rope and then grip the other side of the loop. The rope is shaken off the left hand where the knot has been tied.

The participation of spectators in your performance also increases their enjoyment. An astounding bit with an ordinary handkerchief can be worked effectively with the aid of a person in the group. You tie the handkerchief about his wrist and after seemingly binding it securely, you snatch it off without untying the ends. The trick is simple. Place the handkerchief on top of the wrist. As the two ends are brought underneath to be tied, your right forefinger makes a loop and the left end of the handkerchief is wrapped around this loop. By holding the ends tightly this loop will not slip. Bring ends of handkerchief on top of wrist and knot securely. To release the handkerchief, you pull upward on the two ends with a steady pull.

The assistance of a spectator likewise can be used in your dramatization of the Hangman's Noose. Two solid pieces of rope are shown as you tell the story leading up to the tragedy. You then place them around your neck and a spectator knots them together. With a sudden jerk you free yourself from the "noose" while the knots are still securely tied. Here again there is need of advance preparation. A small piece of thread is used to tie the ropes together in the exact center. This is concealed from the audience by your hand as you show the four ends of the rope. The threaded place is put at the back of the neck, the four ends being brought to the front. After the knots have been tied, the fingers are placed through the ropes and with a quick jerk the thread is broken, releasing the ropes from your neck, and then the knotted loops can be shown.

Another trick improved with patter is

the traveling penny. You borrow two handkerchiefs and after knotting one, it is handed to a spectator to hold at arm's length. A penny is placed in the center of the second handkerchief and you proceed to fold it up. When the handkerchief is unfolded, it is found the penny has disappeared. You explain the coin can be found in the center of the first handkerchief the spectator has been holding at arm's length and your statement is correct.

To do this, you conceal a penny in corner of the first handkerchief at the beginning of the trick. Grasping the opposite corner of the handkerchief you turn it once between your hands. This forms a trough down which the coin can slide. A knot is then tied, the coin being in the middle. This is handed to the spectator. The second penny is placed in the center of the second handkerchief and corner A is brought to C and D to B, then BD to AC. You then grasp corners BD and quickly pull them apart, stretching the corners of handkerchief very tightly. When this is done, the penny will stay in the folds of the handkerchief and by turning it upward the coin can slide into your hand. The handkerchief is shaken but the penny has disappeared. The spectator unties the first handkerchief and the penny is found.

You can keep up a running patter during the card-in-envelope trick. A card is selected at random from the deck and placed in an envelope while you close your eyes or turn your back. The envelope is then sealed, and after deep concentration, you name the card. You must prepare the envelope in advance. A small square is cut from the upper left hand front corner so as to make a window that will enable you to look at the card as soon as it is placed in the envelope. After the spectator has freely chosen a card, he is allowed to place it in the envelope. The card should be inserted with the face toward the spectator while the magician extends the envelope with the window toward the spectator, covering the cut-out section with his fingers. You must hold the envelope at all times. While sealing the envelope you will have ample time to see the card. For best results, use an envelope about the size of a playing card.



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Champion Spark Plug Change Week has become the accepted period for bringing cars up to peak performance. Regularly at this time or every 10,000 miles, motorists have their Champion dealer check their spark plugs. When new spark plugs are necessary, from an economy and efficiency standpoint, they demand Champions because they appreciate the sustained better performance and the gas-saving economy that Champions alone provide. See your Champion dealer this week.

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NASAL CRUELTY! Tom's harsh and heavy tobacco was too much for Polly. Home she went and home she stayed until Tom cleaned his pipe and tried Sir Walter Raleigh.



BLISS FOR KEEPS! Tom and Polly never squabbled from that day on. And how he enjoys those 2-ounce tins of sweet-smelling burley! Smells good to puff and puffed-at!



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Riches from the Air

(Continued from page 875)

duction or destruction, each was dependent on nitrogen and soon the farmer had many competitors for the Chilean nitrates he needed so badly. The demand grew and grew. By 1900 the world was using 300,000 tons of nitrogen each year. By 1912 world consumption was nearly a million tons. Men of vision began to picture a not far distant day when the Chilean nitrate fields would be exhausted. Then, unless some new source of nitrogen were found, the world would starve.

Scientists remembered the nitrogen brought to the earth by rain and snow and decided it was freed by some sort of electrical disturbance. So they took a high-voltage electrical arc and blew air through



Powerful compressors which exert high pressures on gases in making ammonia

it. The nitrogen in the air combined with the oxygen and they got a little nitric oxide on the other side. This nitric oxide, absorbed in water, made nitric acid, from which fertilizers could be derived. But when they got a nice fat spark, the air put it out. So they fanned it out with magnets until it was like a sheet and blew the air through that. This process thrived in Norway for thirty years because Norway could harness her many waterfalls and obtain cheap power. But it required 60,000 kilowatt-hours to produce a ton of nitrogen by this means. Nitrogen sells today for a nickel a pound or \$100 a ton. If it were made by this process, the cost of power alone, at one cent per kilowatt-hour, would be \$600 per ton.

Next the Germans got busy. They found that when calcium carbide, obtained from

452
limestone and coke, was heated, it would absorb nitrogen gas forced across the hot mass. This nitrogen gas combined chemically with the carbide to form cyanamid. And cyanamid can be crushed and put on the soil or mixed with water and made into ammonia, a nitrogen compound.

This process required coal, water and air, instead of only water and air which the Norwegians used, but only one-fourth as much power was required as for the process developed in Norway. The cyanamid process is still employed quite widely today and it was this method that the government intended to use in making nitrogen when the Muscle Shoals development was started.

But several years before Muscle Shoals was finished, a brand new source of nitrogen was tapped. And the man who tapped it was a jovial, little German chemist, Dr. Fritz Haber, who became intrigued by the spectacle of a world clamoring for more and more nitrogen—those 20,000,000 tons resting in the atmosphere over each square mile of land and sea.

Why not, he meditated, combine air nitrogen directly with hydrogen from water to form ammonia instead of digging nitrate out of the ground in Chile or using large quantities of costly power to obtain it from other sources? Ammonia, he reasoned, is composed of nitrogen and hydrogen, so it should be possible to take nitrogen from the air and make the atoms stick to atoms of hydrogen. But they wouldn't combine. Why not? Dr. Haber decided it was because the atoms were not squeezed together hard enough.

So he took nitrogen gas and hydrogen gas, heated them and applied thousands of pounds of pressure per square inch. In his converter he placed a little iron oxide to act as a catalyst and speed up the reaction.

And he got ammonia gas, a combination of nitrogen and hydrogen. The squeezing had forced the two together. Here, at last, was a process for making ammonia—the most desirable primary form of nitrogen—directly from the air!

For in ammonia the nitrogen is locked up and ready for use in making fertilizers, nitric acid or anything else in which nitrogen plays a part. And the cost of power to fix a ton of nitrogen from the air directly with hydrogen is about one-fourth the

(Continued to page 122A)

The Case of a DELCO BATTERY



DIELECTRIC TEST

All Delco battery cases are made of genuine hard rubber in Delco-Remy's battery case plant. Every step in their production reveals the extreme care Delco-Remy takes to assure the *best* in battery construction. Consider a few of these steps:

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(Continued from page 121A)

cost of obtaining a ton by the cyanamid process, or one-sixteenth the cost of the power required to make a ton by the electric-arc process in Norway.

Dr. Haber's process was developed sufficiently in 1913 so that the first nitrogen fixation plants were built in Germany. Then came the World War. The demand for nitrogen soared to new heights—nitrogen for explosives. The first thought of the Allies was to keep the trade routes open for the nitrate run to Chile. But not Germany. Germany was prepared to extract her nitrogen from the air. We intended to get ours from Muscle Shoals if the war had lasted longer. After the armistice, Dr. Haber received the Nobel prize in chemistry for his nitrogen fixation process—laurels of peace for a discovery first used in war. And today the entire world has all the nitrogen it wants, nitrogen from the air for five cents a pound.

But modern ammonia plants bear little resemblance to those early ones. Because of the terrific pressures, pipes in the first plants were as thick as their inside diameters. Even then, no one knew when the steel wall might bulge into a "blister" from the pressure, so the pipes were surrounded by heavy steel and concrete barricades.

The high pressures offered many difficult engineering problems. New steels and other new alloys had to be developed to withstand them. But the problems were solved and the new alloys were produced. Today, in the ammonia plant of E. I. du Pont de Nemours and Company at Belle, W. Va., pressures of 10,000 pounds per square inch cause no more trouble than the pressure at your water faucet.

And 10,000 pounds per square inch is like the pressure which would be exerted by a column of water 23,000 feet high—as high as twenty Empire State buildings. Such pressures are built up by compressing the gases through seven stages, but there is less trouble with leaks than you would have in an ordinary steam line. The squeezing causes the gases to act more like liquids.

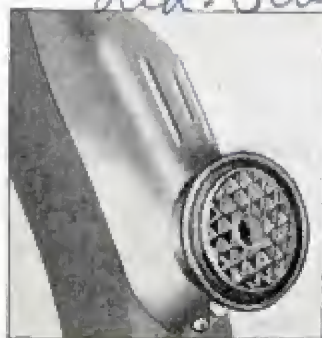
The hydrogen which, with nitrogen, forms ammonia, is obtained at the du Pont plant from coke water gas. Coal is heated to form coke which is gasified, as is done in a gas plant. The result is water gas—hydrogen, nitrogen and carbon monoxide,

the stuff which comes from your automobile exhaust. Blow air and steam through the coke, add more steam to the gas under pressure, with a catalyst to speed up the action, and this carbon monoxide is converted to hydrogen and carbon dioxide. Remove the carbon dioxide with water and you have left hydrogen and nitrogen ready to be converted into ammonia.

Nitrogen consumption has increased seven-fold in the past thirty-five years. The world production today is about 2,500,000 tons annually, about the same as copper, but the capacity of the industry is double that because every nation wants to be assured of a supply of nitrogen in case of war—nitrogen for explosives. But most of the normal world production is consumed in the most peaceful pursuits—fertilizing the soil, making dynamite for construction work, making nitric acid for industrial purposes and making films and dyes and nitrocellulose products.

So there's the ironic story of nitrogen—a substance as essential to life as air or water, something over which nations wrangled for a century and now get in abundance from the air, an element which man requires to keep him in this world and which he uses, on occasion, to blow his fellows out of it, a billion-dollar industry evolved out of thin air.

Double-Duty Taillight for Bike Shines with or without Bulb



Safe whether it is lighted or not, a double-duty taillight for bicycles mounts on the rear fender, its battery case streamlined to fit any standard type. It operates on a

one and one-quarter inch flashlight cell, but even if the bulb is not operating it is an effective guard, for the prismatic ruby glass backed by a powerful reflector picks up every beam from behind and shines red.

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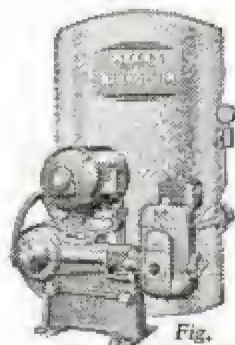
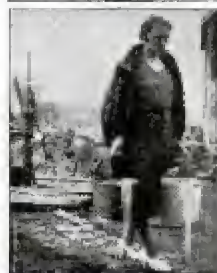
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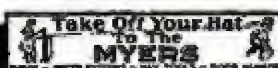
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(WS 8-24)

Brute Force Loses Out

(Continued from page 837)

and sixty-one per cent of the soft-wood consumption is on the east side—2,000 miles or more from the source of supply. In rail shipment of wood, Chicago is the greatest timber port with New York leading in ocean shipment.

The modern Paul Bunyan needs be an engineer as well as a forest technician. The qualified civil or mechanical engineer and the graduate of the modern forestry school are replacing the old-fashioned "bull of the woods." Many modern lumberjacks have college degrees, and one of



Two husky lumberjacks at work on giant Douglas fir in western Washington

the most important members of any logging outfit is the "cruiser" or forest engineer, whose job includes woods survey, spotting and marking desirable timber, projecting roads and bridges to operating areas, and measuring and preparing available waterways for "driving" logs.

Driving logs becomes a blending of the old and new. Portable band saws or motor-mounted circular saws now fell trees many times faster than the most skilled axmen. When the log is "laid" in the woods, a tractor darts into the underbrush, ties on to it with a steel cable, and "snakes" the log to a loading point. There with the aid of electric hoists it can be lifted to giant, Diesel-operated trucks, or carried to "port" by means of an electrical over-

4/82
head tram, then coasted by surface railroad or moved by tractor skidders to a waterway where it is floated or driven, and towed to mill and market.

Through the centuries river driving has remained the most picturesque phase of a picturesque industry. The bulk of the float timber is cut during autumn and early winter. The drives begin in early spring when thaws put the rivers and streams to high-water marks. The best workmen of a logging camp are assigned to the "drive detail." Preparatory to driving, the timber is stacked or skidded to a river bank, or rolled into convenient ponds or reservoirs.

The first job is to get the logs into open channel. Then the driving crew follows in sturdy boats, with high-pitched sharp ends. The boat is navigated by means of long poles which the driver also uses to prod logs into channel and prevent jams. Long-handled canthooks, sharp axes, and the juggler's art of skipping floating logs are other requirements of the driving trade. As a rule driving speed is from twenty to sixty miles a day, with the season ranging from three to eight weeks. Log jams are frequent and when mean clogs occur the drivers must chop them or blast away the jams with dynamite.

In the pulpwood industry, logs which cannot be floated to mill are usually peeled of their bark and stacked for truck or rail haulage. Removal of bark allows the wood to dry and reduces the average weight from 4,400 to about 3,200 pounds per cord. Savings in tonnage justify the expense of bark peeling.

Life in the old-style logging camps was about the hardest known to man. There was no plumbing or laundries or refrigerators. Men slept on wooden bunks without mattresses and lived on beans, brown bread, molasses, and salt pork. But the modern logging camp has its laundry, cold-storage plant, bathhouses, recreation halls. Bare bunks have been replaced with spring beds and mattresses. On the whole, table fare is outstandingly good, with plenty of dairy products, fresh meats, vegetables and desserts. Radio and telephones keep the camps connected with the outside world.

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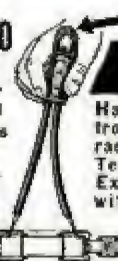
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Age of the Aerial Monsters

(Continued from page 844)

automatic controls are used in the engines, manual over-ride controls are attached for possible use from the cockpit in emergencies.

The power of aviation engines has been climbing upward for years. In 1930 the Pratt & Whitney Wasp was rated at 420 horsepower but today the same engine delivers 600 horsepower with hardly any change in size. The increased output is due to improvements that include refinement of cylinder design and higher compression ratios and supercharging. These last two improvements are possible because of the better fuels that are available today and in turn permit a higher number of engine revolutions per minute, which results in greater horsepower.

Other engine improvements include hollow valves filled with sodium to promote cooling, tougher alloys that are better able to withstand the higher crank speeds, and redesigned fins on the air-cooled cylinders which together with pressure baffles that force the air to circulate between the fins result in better control of engine temperatures.

The trend in engine design seems to be toward more and smaller cylinders, providing a smoother flow of power with less vibration. The two-row radial engines are a development of this trend, as well as an answer to the cry for greater horsepower. The new R-2180 Twin Hornet, made by Pratt & Whitney, is a fourteen-cylinder twin-row radial with a displacement of 2,180 cubic inches. Four of these are installed in the new Douglas DC-4.

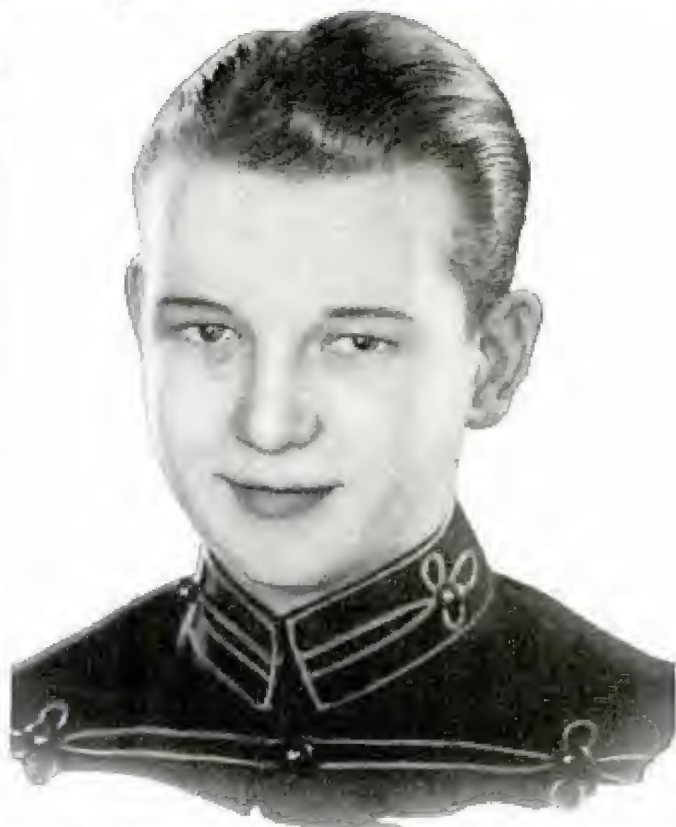
Even more powerful than the Twin Hornets are the new 1,500-horsepower Wright Cyclones of similar radial type that are being used to power the new Boeing four-engined flying boats that carry seventy-two passengers.

Today the engine manufacturers are working on engines of even larger horsepower. The day of the 2,500-horsepower aircraft engine is almost in sight and when such power plants are available larger aircraft than ever will be possible.

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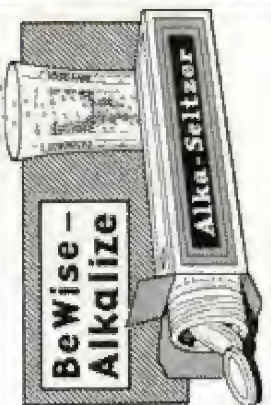
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NBC NETWORK

Don't Pity the Poor Fish

(Continued from Coloroto Section)

factory wastes. Game fish rarely can survive such contamination. Therefore game fish fanciers are urging better care of native streams.

Modern trout breeding has become a highly exacting science. In the rearing stations the best fish are saved as breeders and carefully selected for color, shape, and health. In some instances native or "wild" trout are trapped for breeding purposes. This is done by weirs, or concave net traps. The fish are stored in floating wood "cars" or box rafts until spawning time, and are usually released after the egg crop is harvested. Modern trout hatching has become highly artificial. Fish eggs and "milk" or male fluid, are stripped from the breeders in the fall, pending a necessary hatching period of from sixty to ninety days.

Trout milking is a delicate chore which requires clean hands and strong fingers. An expert can tell when a trout is ready to spawn from the feel of the abdomen. Eggs are forced from the female by hand and deposited upon wooden trays. The milk or fertilizing fluid is forced from the male fish, poured over the egg trays and allowed to stand for about twenty minutes. Temperature must be checked carefully. Then the eggs are placed in a current of cold water where they remain until hatching time. The first hatching stage is the sack or "eye" stage. Two tiny black dots appear in the fertile eggs, which look like tiny pearls. These spots become the trout's eyes. When hatching is finished, first-stage minnows are transferred to breeding pools and put on a liquid diet.

Don't be surprised if you catch a trout with a calling card. The card is likely to be a small non-corrosive plate clamped to the heavier muscles of the tail. It lists various information in code form and asks that you return the card with various other information to a state fish commissioner or the U. S. Bureau of Fisheries. You'll aid the future of American fishing by honoring the request. Fish tagging is becoming an extremely helpful device for estimating range, distribution and rate of growth of fish. The U. S. Bureau of Fisheries is applying it not only to fresh-water game fish, but to salmon and herring, shrimp, lobsters and crawfish.

Calling cards for salmon are usually

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small celluloid disks inserted by means of copper wires just above the spine. Shrimp and crawfish cards are wired to the tail. The herring is the hardest to mark. His calling card is usually a small oval disk which must be rammed down his throat. This doesn't seem to harm the fish but when first inaugurated it practically halted the herring industry.

Herring are usually seined and ground into meal. Tags are not visible and when fast-rotating grinding blades struck the steel disks it was too bad for the machinery. Herring processors tried using power magnets to detect the presence of the disks, but this was not certain enough. Now the Bureau of Fisheries has an electric tag detector which does the trick.

As the fish slide down a chute into the reduction machines which grind them to meal, they pass over a trap door. The electric detector records the presence of any tagged fish and opens the trap door. The tagged fish then falls into a bucket and is claimed by the bureau for its records.

While trout and bass tagging now promises excellent results, the most notable accomplishment to date is that of tagging salmon. The bulk of our \$50,000,000 salmon catch is made in fresh water. Tagging experiments have enabled salmon experts to learn two important facts—that the fish dies shortly after spawning, and that by instinct a salmon tries to return and spawn in the same waters in which it was hatched—even though this is a small and remote creek.

Tagging enables Bureau of Fisheries employes to find the spawning places of the more valuable varieties of salmon. Acting upon the proven fact that the fish return to their birthplace to spawn, bureau field men remove the desirable types of spawns to other streams. This serves to open entirely new salmon runs, and helps replace the poorer varieties with the more valuable.

Tagging is also being used on codfish, weakfish, jack salmon, perch and various other varieties. It helps fish experts to predict the supply and location of a given variety and facilitates fishing laws based upon scientific probability.

❏Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

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No. 40



HOW TO CHOOSE BETWEEN PIPES —before smoking them

Naturally there is a difference between how a cheap pipe smokes and how a good pipe smokes. But how can a pipe smoker tell what that difference is going to be, *before* he smokes them?

This way: look at the markings of the briar. The more beautiful and fine-grained the briar, the sweeter the pipe will smoke. The finest briars come from big, *old* briar burls, mellowed and matured for 100 to 400 years in the ground.

These old burls, obviously, are scarce, and cost vastly more than young, immature, small burls. When cut and polished, the briar from these burls makes the most beautifully marked pipes that you can buy.

So, look at the markings of the briar. Look at any ordinary pipe—and then look at the markings of a Kaywoodie. That's a good way to tell how much sweeter-smoking Kaywoodie pipes are. Kaywoodie Company, Rockefeller Center, New York—and London.

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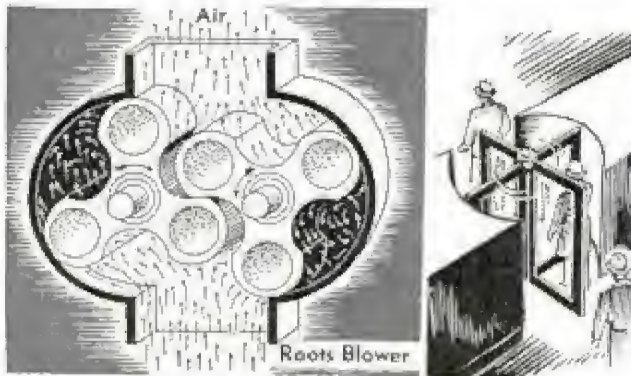
When writing please mention Popular Mechanics

The Advance of Diesel

(Continued from page 829)

Normal compression in the cylinders of a gasoline engine is about 125 pounds to the square inch. Diesel compression is many times higher. This compression, without use of spark plugs, is great enough to create a heat which will burn any type of fuel. The instant it is blown in, the fuel ignites like a flash of grease in a frying pan.

The first compression engine was described by a Dutch scientist named Christian Huyghens, back in 1680. It was designed to burn gunpowder. Dr. Diesel's original engine burned powdered coal. The present Diesel could be made to burn either solid or liquid fuel, so long as the fuel is ground or sprayed in a fine vapor



Roots blower operates somewhat like a revolving door in delivering air to engine cylinder

form and so long as the fuel does not have an ash which damages the piston walls.

Actually most Diesels are fueled with a petroleum distillate similar to that used in oil furnaces. But under proper conditions the mechanism might be operated with many different types of combustibles including gasoline, animal greases, glycerin, alcohol, or even salad oil. This versatility may be important to future developments in motor fuels. If any major emergency should cut off the supply of gasoline, an entire structure of Diesel power might be operated upon substitute fuels.

Here are some average percentages of efficiency for common power sources: Simple steam engine, six to eight per cent; steam turbines and condensing steam engines fifteen to twenty-seven per cent; modern auto and airplane engines, twenty-two to twenty-eight per cent; Diesel engines, thirty-two to thirty-eight per cent.

(Continued to page 132A)

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DELTAS**



(Continued from page 131A)

Problems of weight, fuel feeding and strength of materials have been the three great Diesel drawbacks, from a standpoint of everyday use. The earlier models were too heavy to be practical anywhere except for stationary plants or as boat engines. Weights were about 250 pounds per horse-power developed, as compared with eight or ten pounds per horsepower for the automobile engine. Walls had to be heavy in order to withstand the extremely high pressures in compression, which also placed extreme demands upon connecting rods, bearings, crankshafts, etc. But the new developments and substitution of the two-cycle for the earlier four-cycle Diesel have already reduced weight requirements until the new 600-horsepower eight-cylinder Diesel now weighs only about twenty-three pounds per horsepower, and the sixteen cylinder only seventeen pounds per horsepower.

Rapid progress is being made in the matter of fueling. All the new Diesels use the unit injector which provides a small pump for each cylinder. By means of nozzles with holes about the diameter of a small needle these pumps feed the fuel into the cylinders in the form of a fine misty spray. Pressure in the fuel-pump cylinder reaches 20,000 pounds per square inch and averages about 15,000. This forces the fuel oil through the spray hole tips at a speed of about thirteen miles per minute.

In the new streamline-train Diesels, the fuel oil used for one charge to one cylinder varies from the size of a grain of rice to that of a small pencil eraser.

H 323

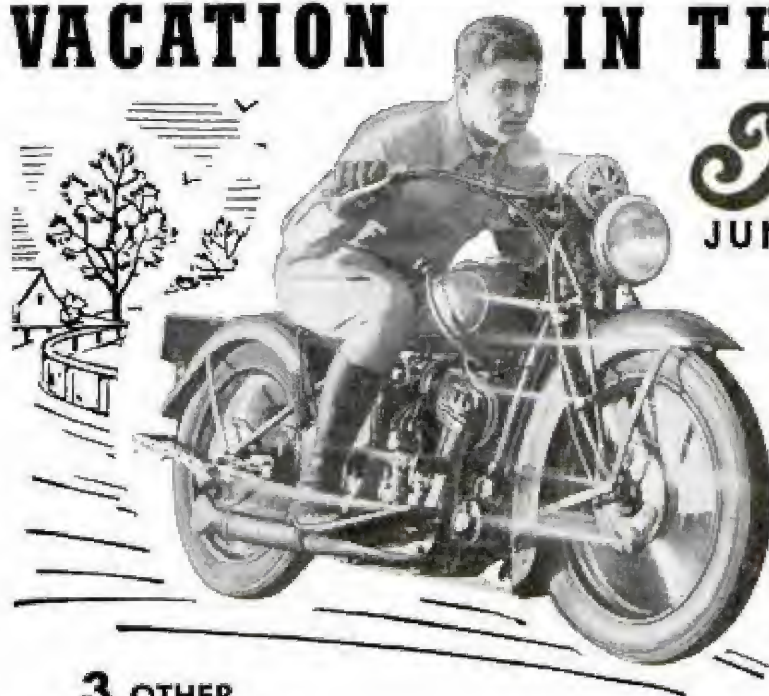
The Latest Movie Thrills

(Continued from page 821)

was then masked off, except the few buildings and the street. Next Fulton built a miniature set consisting of additional houses, part of a bridge, and a railroad train steaming along under one arch of the bridge. Parts of this scene were masked off so that the parts left would match with the street and the town in the first strip of film. Next he obtained a reel of film showing water moving down a river, and on this reel everything was masked off except enough water to fit into the completed picture. Finally a strip of film con-

(Continued to page 135A)

VACATION IN THE OPEN



Indian
JUNIOR SCOUT

F.O.B. FACTORY

\$215.

FULLY
EQUIPPED

Get out in the open this summer! Explore highways and byways! All outdoors is yours—for fun, excitement, adventure—when you ride a TWIN-CYLINDER Indian Junior Scout—the biggest "buy" in all motorcycling.

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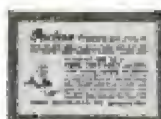
The new 1938 Indians are as easy to buy as they are to handle, and you can't beat 'em for economy and smooth, dependable operation. Ask your Indian dealer to demonstrate an Indian—explain Indian's easy pay-as-you-ride plan.

3 OTHER NEW 1938 MODELS

DE LUXE 4—the only American-made 4-cylinder motorcycle.

CHIEF 74—a peerless "top speed" performer.

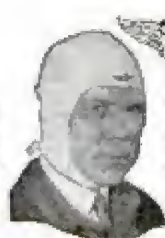
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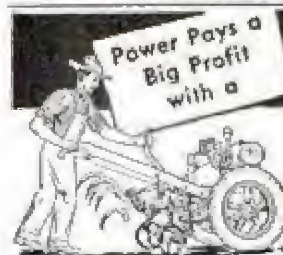
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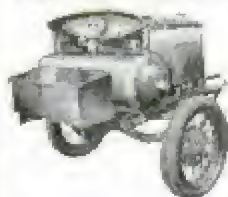
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With a Ford Motor and shop facilities you can assemble your own compressor. We will furnish a Smith Compressor Head and Accessories with instructions for mounting. Write Dept. D for details stating the use you have in mind.

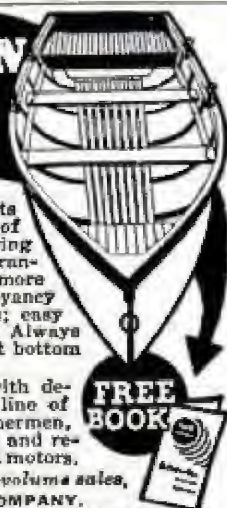
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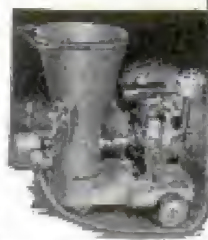


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TINYTONE RADIO CORPORATION, Dept. P-5, Kearney, Neb.

(Continued from page 132A)

taining moving clouds was worked in. When it was finished no one could tell that the scene was fictitious.

Several years ago Fulton was handed the plot of a thriller that almost made his hair stand on end. The story called for three people in a mountain cabin to be marooned by a forest fire and then, as the fire closed in, for them to escape in a canoe down a turbulent mountain stream, while giant trees on both banks flamed like torches and crashed into the water. The producer wanted the camera right alongside the canoe so that he could show the contorted faces of the actors as they fought the flames and the hazards of the stream. Fulton did it by filming the stream and forest fire in miniature and then inserting a full-sized canoe and the actors into the same scenery. First he built the stream, eighteen inches deep and 150 feet long, with a twenty-mile-an-hour current. The forest was simulated by planting dry eight-foot-high yucca stalks into which trimmed branches of inflammable manzanita had been inserted to represent limbs. Concealed in the ground on both banks were pipes that sprayed a mixture of kerosene and alcohol into the air when a valve was turned.

Then with the water rushing down the stream, the valves turned on, and the miniature forest blazing angrily, Fulton dressed in an asbestos suit and crouched over a camera mounted on a wooden float. With the camera turning, he slowly pushed his way down stream. Flaming trees crashed in front of him and flames met overhead as the camera rode the rapids and twisted its way around rocky ledges.

Putting the actors in the canoe was next on the program. On each side of a narrow lake Fulton erected tall telephone poles and connected them with overhead cables. A canoe resting on the water was attached to the cables by thin invisible wires, permitting people out of camera range to dip and tilt the canoe by working the wires. With the actors in the canoe registering fear at the proper times and desperately trying to paddle away from dangers at other times, Fulton filmed the canoe as it bounced, swung around, and dipped in response to the overhead wires. Then the two films were joined together and a final print was made.

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Send dime for beautifully illustrated catalogue.

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Electric Plants Offer Power

(Continued from page 852)

300 to 5,000 watts, homemade electricity is produced without batteries, and regular city appliances can be used with it. The operating cost will be higher than for an air-driven plant, but the initial cost is likely to be lower than for a wind system of equal capacity. An electric refrigerator employing a brine tank is available for such systems. The plant is not operated continuously and the brine retains the cold.

Small Diesel plants are used mostly where two or three neighbors share the expense of producing current because the output of such a plant usually supplies all the juice needed by more than one household. The same idea is employed sometimes even in homes connected to the high lines. In such homes, the equipment is intended principally for emergency use.

With heating systems, refrigeration and other necessities depending more and more on an uninterrupted flow of current, some households are installing some kind of plant for producing homemade juice in the event high line service is interrupted. One of the most popular is a gas-engine generator unit which starts automatically when the regular current fails and stops when service is restored. Such an installation does not require separate wiring, and lamps for the unit are connected direct to the main panel board. The only battery needed is a small one for starting and this is kept charged by a trickle charger connected to the regular source of supply.

Another unit which can be used for emergency service is the large glass-cell storage-battery kind. A change-over switch throws on the current from the batteries when service is interrupted but, with this system, a separate emergency circuit must be provided, including the lights themselves, because batteries store only direct current. For emergency purposes, a unit with a capacity of 400 or 500 watts is likely to be sufficient to operate a home heating plant or a refrigerator, a few lights and perhaps keep a water supply going during an emergency.

Cities have been made over by electricity. Night has been turned into day, work has been lifted from weary shoulders in home and factory, the wheels of industry are turned by electric motors and electri-

(Continued to page 139A)

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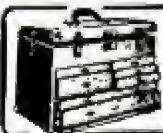
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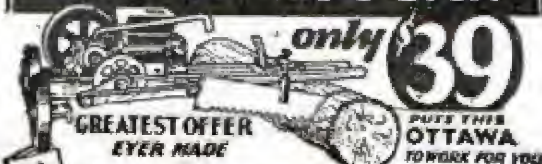
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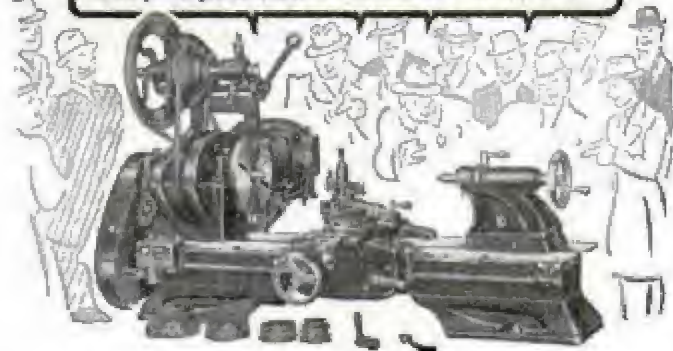
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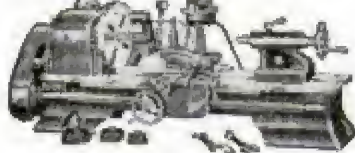
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See Article April Popular Mechanics—Page 611

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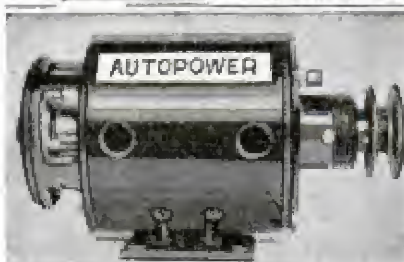
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(Continued from page 136A)

cally operated conveyances ranging from trolley cars to elevators carry millions of people many billions of passenger-miles each year. What has happened in cities indicates what will happen in the country when electricity is put to work on the farm.

Less than eighteen per cent of America's farm homes are served today by the high lines. Of that number, and of those making their own current, few are using this energy to do more than supply lights, operate a few household appliances and perhaps pump water. And yet, much farm work done with other power could be done better and cheaper by electricity.

There are more than 250 ways in which electricity actually is being used in rural districts today, and these jobs range all the way from tending the pigs and hatching chickens to clipping the hair of prize steers and milking the cows. A lightly charged wire, it has been found, discourages pigs and cattle from straying out of bounds.

In 1925, American farmers, it was estimated by the government, used about 47,000,000 horsepower in agriculture—twice as much as was used in manufacturing. This power, derived from horses and mules, oil and gas engines, wind, water and electricity, cost an estimated \$3,000,000,000. Electricity did only about four per cent of all this farm work. In 1930, the available horsepower for agriculture had increased to about 70,000,000, of which only about 3.1 per cent was electrical.

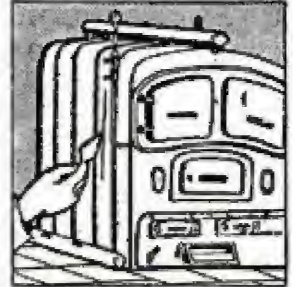
The average cost to farmers for the power used in 1925 was estimated at nineteen cents per horsepower-hour or about twenty-five cents per kilowatt-hour. It was also estimated that it cost a farmer twenty-five cents to work his own horse for one hour. That's the cost of a horsepower-hour supplied by a horse. But electricity can do many types of farm work for anywhere from five to fifteen cents per kilowatt-hour, depending on the task and the source of the electrical energy.

Shortly before his death, Thomas A. Edison declared that "the electrical development of America has only just begun." Perhaps he had in mind the day when the blessings of electricity will be bestowed as freely on the rural resident as on his city brother. For electricity is the servant of all, a tireless, versatile worker which plays the radio, saws wood, lights the home or churns butter with equal ease.

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at crack

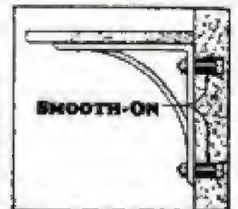


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loose
handle

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Anchoring in
masonry

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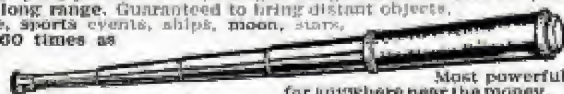
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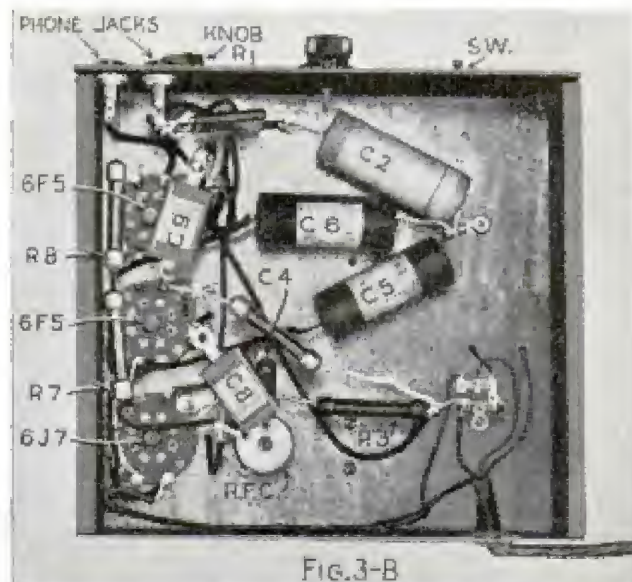
Radio Direction Finder

(Continued from page 899)

piece of broomstick and the bottom end is drilled and tapped for a machine screw which grounds the rod and holds the assembly on the chassis base. The upper section of broomstick rotates with the direction scale. The flexible insulated outside loop leads (2 and 3) are tied or taped to the upper stick. Leave slack in these leads to permit just one complete rotation of the loop.

Tuning condenser (C) is mounted on four $\frac{5}{8}$ -in. porcelain stand-off insulators and the shaft extension to the dial on the front panel is a Bakelite rod, thus insulating the condenser from the metal base and front panel.

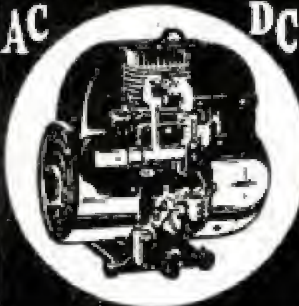
For the direction scale, cut strips $\frac{3}{4}$ in. wide from cross-section paper ruled 10 or 20 divisions to the inch. Paste the strips



together to make a total length of a little over 18 in. Mark off the strip to correspond to compass degrees, reading from 0 to 360 left to right, with 20-degree markings every inch. Glue this strip on the edge of the wood disk which is $\frac{3}{4}$ in. thick and $5\frac{3}{4}$ in. in diameter. If diameter is not exactly right to make the zero mark come around and overlap on 360-degree mark, sand disk down or build up with strips of paper as required. An index marker for the direction scale is made from a short piece of bus-bar wire which is fastened under a screw head at the top of the front panel. A round-head wood screw is placed in edge of the disk for a stop. A list of the original parts, with additional operating

(Continued to page 142A)

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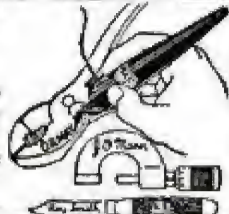
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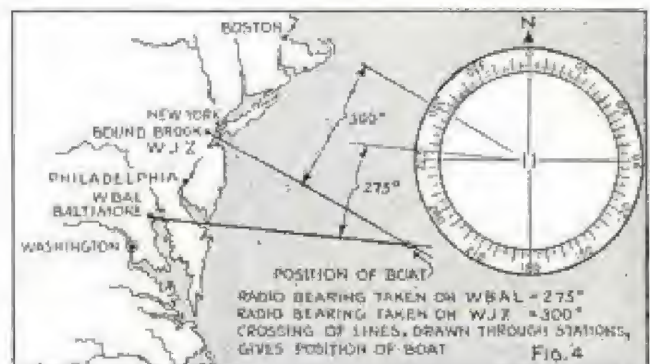
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(Continued from page 140A)

data, can be obtained from Popular Mechanics radio department without charge. The blueprint number is R-254.

Photos Figs. 3-A and 3-B show top and underside views of the completed unit; A, B, C and D illustrate applications. There will be a very slight drain on the B-battery at all times, therefore, if the set is not used for several days it is a good idea to disconnect one side of the B-battery.

There are two general types of radio direction finding: one, to locate your own position, and the other, to locate the position of an unknown station. In both cases a map of the district, or section of coast line is necessary. Two or more stations are tuned in and direction bearings read on each. For example, Fig. 4 shows how the position of your boat is easily checked. For land use, the set must be carried from spot to spot, at each of which a bearing is taken, and drawn on the map as a line



through the respective spot at the indicated angle. Two or three lines will cross at the approximate location of the unknown station. The loop, when rotated, will pick up a station without great differences in strength except for a narrow region when the loop is broadside to the station. Here the signal strength goes down, and if the loop is well balanced, the signal will go to zero at a definite point and readings will be accurate. The loop might be compared to a wagon wheel, and, when turned for zero pickup the axle of the wheel points directly at the station. The loop should be turned so that its imaginary axle points due north and south; next adjust the direction disk and fasten it to the broomstick so that bearings in compass degrees may be transferred directly to a map. In portable use, allowance must be made in setting up the receiver to make the direction index scale read zero when the loop "axle" points north.

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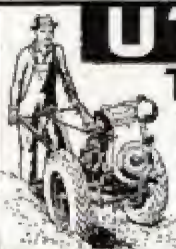


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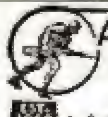
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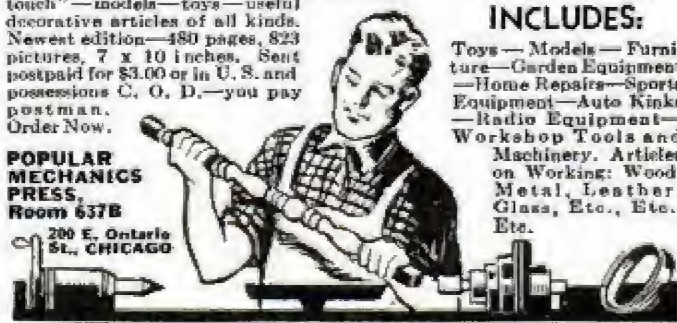
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When writing please mention Popular Mechanics

Phantom Fleet of the Highway

(Continued from page 861)

ular intervals. A chemical analysis of the oil shows how much dirt each filter removes and its point of failure.

Chromium parts are punished to destruction in a salt spray room while in a soundproof room, the quietness of gear assemblies is checked. In contrast to this silent room, there's another where horns blow night and day until they fail. And there's also a dark room where lights are checked with the aid of checkerboard patterns on the walls. One of the headlamp tests involves stripping off the pure silver



Applying 2,000 pounds tension in testing the steel-and-rubber bond of an engine mounting

coating on the reflector. The silver is precipitated and weighed to make sure there's the proper amount on each reflector.

On a "twist rack" powerful jacks subject the frame to terrific inequalities of pressure to test its rigidity, while steering wheels are sandbagged by dropping heavy sacks of sand on them to prove their strength. One machine tugs away trying to tear apart the bond between a rubber engine mounting and the metal and another jiggles valve springs up and down until they break.

Over and over, thousands upon thousands of times, one piece of apparatus does nothing but apply the brakes and release them. An engineer checks at regular in-

(Continued to page 146A)

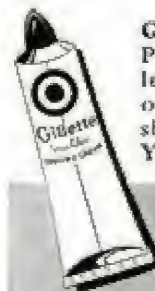
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Prepare your beard for perfect shaves with Gillette's New Brushless Cream. Made with peanut oil, it softens wiry whiskers, stays moist, speeds shaving, won't clog your razor. Try a tube. You'll like it! Large tube only 25¢.

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The load may change but the **PIERCE UNIVERSAL GOVERNOR** will maintain a uniform engine speed. For close regulation of speed and dependable performance **PIERCE GOVERNORS** are never equalled. Installation is simple. Either V or flat belts can be used. Complete Governor outfits are also available for nearly all makes and models of industrial engines.

Write for illustrated literature and prices.

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PIERCE GOVERNORS
 THE BRAINS OF ANY GAS ENGINE

(Continued from page 145A)

tervals to see how each part functions. There's also a balancing machine for checking experimental parts, an apparatus for making a fatigue test on front axles and another for finding out quickly how long ball bearings will last. Brake cylinders, pistons and rubber cups are tested for endurance on a structure consisting of eight complete brake assemblies with provision for applying pressure in the hydraulic system.

One of the tests for steel is to grind down into the metal a tiny ball of super-



Cigarette papers clipped to leather samples test color-fastness of dyes in upholstery

hard steel under tons of pressure. A microscope measures the "dent" which reveals how the metal will stand up under twisting, pulling or bending stresses. Leaf and coil springs are "bumped" or flexed up and down for days on end while in the same room hydraulic shock absorbers are vibrated until they go to pieces.

Working part surfaces so smooth that a special instrument had to be invented to measure their departure from perfection are accurately gauged with a "profilometer" which, when drawn over a surface, magnifies a scratch hundreds or even thousands of times, revealing imperfections under one-millionth of an inch. There are torsion tests for crankshafts, water brake engine tests for transmissions, combined compression and tension tests for other parts. Various types of fuel pumps are tested until they fail and, in the electrical laboratory, generators and distributors are punished in like fashion while banks of storage batteries are alter-

nately charged and discharged to determine the exact life of each kind.

Even the upholstery must pass rigid tests. The fading qualities of cloth, leather and other materials are determined quickly in the "fadeometer" which, in a few hours, exposes the materials to more ultraviolet light than they would receive if they stood in the sun for a month. Another machine subjects the materials to violent twisting and flexing hour after hour to determine their strength. If leather carries pigments and dyes which might stain clothing, an ordinary cigarette paper reveals it. The paper is clipped to the sample which is heated in an electric oven. If the paper is stained, clothing may be stained too.

Out of all this rigid testing—road and laboratory—come better automobiles. Your car dollar today buys more than ever before, more safety, more comfort, more miles of service. For most of this extra value you are indebted to the torture chamber boys and the "hell drivers"—the fellows who do to your car before you buy it all the crazy things you are likely to ask of it after you buy it.

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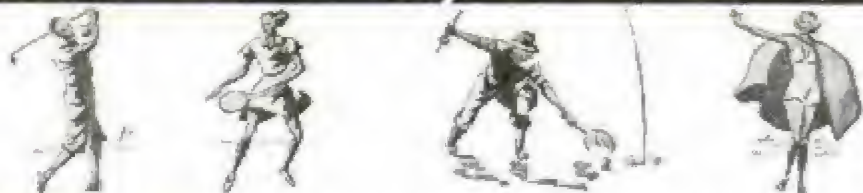
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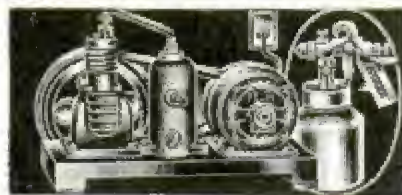


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American Drivers Against World

(Continued from page 869)

allows him to drive through the turn and enter the next stretch with hardly any loss of momentum.

Typical of the new "compromise" cars suitable for both speedway and road racing that are being built this year is the new Belanger Special that Bob Swanson is slated to drive. The unsupercharged straight eight engine is of 248 cubic inches displacement, developing in excess of 200 horsepower at 6,000 revolutions per minute. Bore is three and five-sixteenths and the stroke is three and three-fourths inches. The compression ratio will be twelve to one or better, depending upon its performance in track trials. The engine has nine main bearings and double overhead valves. It is equipped with a self-starter to eliminate pushing after pit stops. The gear box has four speeds forward as well as a reverse and is ruggedly built to permit shifting down from high gear even when the car is rolling at around 140 miles per hour. The purpose of this is to increase deceleration when going into turns on road courses. Few if any of the American cars will use self-shifting or pre-selective gear boxes.

The completely streamline body is only five and one-half inches off the ground and measures forty-two inches from the ground to the highest point. The complete car weighs 1,800 pounds and is streamline underneath as well as on top. The car has a 103-inch wheel base and a sixty-two-inch tread, using 6.00x18 tires in front and 7.00x18 tires in back. The four-wheel hydraulic brakes are sixteen inches in diameter and two inches wide, operating from two master cylinders, and with a foot pedal on each side of the cockpit. The purpose of the left-hand pedal is to permit braking the car for short stretches while the driver's right foot still holds the accelerator pushed to the floor, a desirable maneuver in road racing. Heavy radius rods are attached to the front axle to take the brake torque. Front springs are semi-elliptic and the rear springs are transverse. Because of the cost and lack of engineering experience with the design, none of the American cars may adopt independent springing this year. Thirty-seven

(Continued to page 150A)

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2 UNDERWATER EXHAUST: No exhaust noise. No exhaust fumes.

3 FULL PIVOT REVERSE: The only outboard motor development that gives you 360° steering and REVERSE!

FREE! WRITE for the new Sea-Horse Handy Chart of motor sizes and specifications describing all nine outboard motors of the 1938 Johnson line. See the new bantam weight model MS, with patented co-pilot, underwater exhaust, synchro-control and REVERSE! Deluxe model MD with Ready-Pull Starter, \$62.50 f. o. b. factory.

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JOHNSON Sea-horse OUTBOARD MOTORS

MODEL MS

\$49.50
f. o. b. factory




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Don't let slow, tiresome, tedious hand sanding and scraping spoil your finishing and refinishing pleasure. Do it this modern, efficient way with a Take-About. No experience necessary, just plug it into the nearest light socket and it will do your job in a jiffy. Use it on straight or slightly curved surfaces. Use the front pulley as a spindle sander on curved work.

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WRITE for photos, complete details and the very Low Price. Send postcard or letter today.

(Continued from page 149A)

gallons of fuel are carried in the tail fin tank, twenty quarts of water in the radiator, and seven gallons of oil in a tank immediately in front of the cockpit, with fins projecting up into the air stream to promote cooling. The instrument board, holding switch, tachometer, oil and water temperature dials and oil and fuel pressure gauges, is insulated from the body to eliminate vibration that would make the gauges hard to read.

Designed by Art Sparks, two identical race cars are being built for Jimmie Snider and Joe Thorne. Each of these cars has a six-cylinder engine operated with a special centrifugal supercharger at a compression ratio of eight to one and will turn up to 7,500 revolutions per minute. These cars will be lower than ever, being thirty-seven inches high and having a clearance of only four inches from the ground. The driver sits nine and one-fourth inches above the ground. The streamline bodies are offset slightly on the frames to help get the driver down low alongside the drive shaft and are built exclusively of chrome molybdenum steel. Large brakes, special four-speed transmissions, and a new kind of welded front axle that eliminates all bolts and brackets are used in each car.

Fred Offenhauser, builder of many racing engines, has built a new four-cylinder supercharged engine of 181 cubic inches displacement for Leon Duray, and a 181-cubic inch eight-cylinder supercharged engine for Louis Meyer that will develop 275 horsepower at 6,500 r.p.m. These engines will carry from fifteen to twenty-two pounds of supercharger pressure to balance their low-compression ratios. Offenhauser has also finished a new 270-cubic inch unsupercharged engine for Pete Alberts that develops 250 horsepower at 5,000 r.p.m. Louie Tomei will drive Ted Horne's new four-cylinder car that has cross springs in both front and rear. Rex Mays will drive an Alpha Romeo that has been rebuilt and streamlined and Babe Stapp and Wilbur Shaw are each driving new cars. Kelly Petillo has put all new moving parts in his 272-cubic-inch four-cylinder engine.

These are some of the American cars that will race for glory and a share of the prize money.



NOW a DYNAMIC HEAVY DUTY INDUSTRIAL WELDER

WORKS OFF 110 VOLT ELECTRIC LIGHT CIRCUIT

For this unheard of price, you can get the marvelous Dynamic Super-Charged Welder complete—all ready to plug into your light socket. The Dynamic does both metallic arc and carbon arc welding.

WELDS CYLINDER BLOCKS, FENDERS, AXLES, BODIES, BUMPERS, FARM MACHINERY, CAST IRON RADIATORS, ETC.

With the Dynamic Super-Charged Welder, a man without previous welding experience can make for himself as much as \$5.00 on a repair job that can be done in less than one hour. Many welders make as much as \$15.00 to \$20.00 a day. Despite its serviceability, the Dynamic Welder is light and easily portable—can be carried around by hand and set on the running board of any car you are working on.

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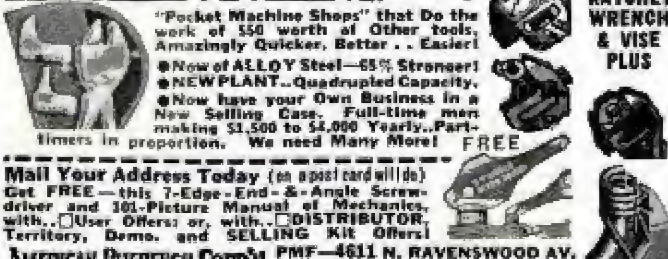
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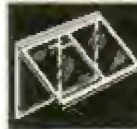
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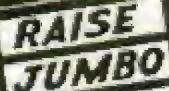


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SEND NO MONEY Just send name and address and get our money-making plan, startling **OFFER** to beginners and complete information. Absolutely **FREE**, no obligation. Season now on—hurry! Write today.

J. B. Frog Company, Dept. 3-A Memphis, Tenn.

Newspapers that Talk

(Continued from page 808)

not only photographs and a description of the catastrophe, but also sound of crashing walls, voices of eye witnesses and other related sounds which the newspaper reader may hear from his favorite paper the same evening.

Mr. Ehlert estimates that the sound tracks on paper will run through the home reproducer ten or eleven times before getting noisy. Newspapers get torn so it will not be a permanent record.

"The sound reel is similar to a moving-picture reel, except that it is much more economical to reproduce," said Mr. Finch. "The material of this reel is preferably opaque and may be paper upon which the sound tracks are printed by ordinary printing operations. The printing operation also may be performed photographically upon sensitive paper or film to accomplish the same result.

"The sound records of my present invention may be used for quality acoustic reproduction including lengthy musical renditions. However, the widest utility of this invention is in conveying intelligible speech. Accordingly, by limiting the frequency response of the apparatus to about 2,200 to 2,500 cycles, a slower rate of sound-track scanning and simpler electro-optical design as compared to talking moving-picture apparatus will prove adequate.

"The preferred scanning equipment of the home reproducer comprises a light source focused upon the sound track and a photoelectric cell sensitive to the varying light intensities refracted from the record. A preamplifier, consisting of one or two stages of audio-frequency amplification, is associated with the photoelectric cell to amplify the relatively weak electrical signals generated by the photoelectric cell.

"The reproduction apparatus for the newspaper sound strips operate by frictional feeding. A notch cut at a predetermined portion of the sound strip actuates a relay for shifting the sound strip transverse to the scanning beam in order to bring the next adjacent sound track into scanning position.

"Where the strip is formed into an endless belt, the shifting occurs at the joint between the beginning and end of the belt.

(Continued to page 155A)



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Amazing money maker for farms, truck gardens, orchards, nurseries, poultry ranches, country homes, etc. Plows, discs, harrows, cultivators, mow lawns, cuts weeds, runs belt machines, 2 to 5 ft. riding or walking types. Write for FREE CATALOG. Low Factory Prices and 10 day Trial Plan. Address General Office, SHAW MFG. CO., 4506 Front St., Salsburg, Kans. 130 G West 42nd St., New York, N. Y., 5812 G Magnolia Ave., Chicago, Ill., 668 G North 4th St., Columbus, O.

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Learn how you can build up a profitable spare or full-time business in your own home. This new book "How to Make Money in Woodworking" is crammed with practical tested ideas, plans, and suggestions. Tells you exactly what to make, how to make it and how to sell it. Describes plans that have worked for others. Woodworking, the new way, is light, pleasant, and profitable. Send only 10c and complete book will be mailed postpaid. Satisfaction guaranteed or money refunded. Write to Dept. A638.

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IN THE MODEL OF YOUR
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JUST like hundreds of other famous hitters in years gone by, "Ducky" Medwick knows his baseball bats and has picked Louisville Sluggers to get his hits and to recommend as the finest ever made. Choose your hats as the big leaguers do and insist on the autograph of your favorite player and the famous Louisville Slugger trade mark on the bat.

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SLUGGER BATS**

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Order from this Ad and get a Beautiful Cowhide Carrying Case FREE, with hotel strap and shoulder strap. Regularly priced at \$5.00. For free gift, send money order \$10.00 to PARAGON CAMERA COMPANY, Fond du Lac, Wisconsin. Reference: National Exchange Bank, Fond du Lac.

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With Amazing FLUX DIVERTER
Thousands of PARMAS now in use. One used barbed wire on light stakes cuts fencing cost to \$10 a mile. Only PARMAK has exclusive New Flux Divertor—doubles life of SAFE 6 volt battery! Fences entire farm; gives sting that holds stock like steel and concrete.

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Write today for FREE CATALOG and long term guarantee.
AGENTS—Write for money-making and exclusive territory plan.

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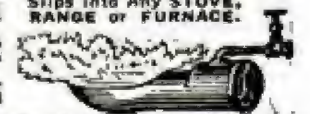


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WHY COOK OR HEAT with COAL or WOOD
Quick heat at turn of valve—over 40,000 sold, no dirt, ashes or drudgery. Burns cheap oil new way—no clogging up or carbon.
WRITE FOR CIRCULAR and AGENTS PLAN—Let us show you how it ends work and dirt of coal and wood.
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Just couple your own engine to this unit, export it as cheaply and you have money-making advantage of a portable welder of a range of \$100 to \$500.



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Gentlemen: Send me information on () Build Your Own Welder () Electric Drive Welder () 30 Days Trial, Easy Terms () Rental Plan. Also send me free books I've checked.

Name _____

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(Continued from page 153A)

Accordingly at the moment one sound track is scanned completely, corresponding to one revolution of the endless belt, the scanning operation is continued at the beginning of the next adjacent sound track."

Two simple reproducers have been designed. The first, somewhat resembling a child's movie machine, will make audible the continuous strips cut from margins of a talking newspaper. The second, which looks like an old-time phonograph using cylindrical records, will take the strips in spiral form and also the lengthier "sound features" cut from the newspaper itself.

Newspaper men point out that when the talking newspaper becomes a reality, the character of journalism will undergo considerable changes. A sound studio, in which a commentator, actors who imitate the voices of cartoon characters and other personnel will find new opportunities in newspaper work, will be necessary.

Mr. Finch points out that a "radio newspaper" may be made possible by combining the reproducing device with a facsimile recorder. By this means it will be possible for a person to set a facsimile recorder to operating when he goes to bed and, the next morning when he gets up see a printed preview of the news which was broadcast from a radio station during the night. He will be able to hear the more spectacular events by detaching the strips of sound waves and running them through his home reproducer.

Wings for Crime Hunters

(Continued from page 802)

was screened by tall trees and brush. Boats were put out and the family of nine brought to shore in time to see their house float into the Pacific ocean.

San Diego's sheriff's department has found the airplane invaluable, due to the large area the county covers. Some 4,200 square miles of every type of topography, from seashore to 6,000-foot mountains and then to desert below sea-level, constitute the "beat" of the San Diego sheriff. The innovation of airplane policing has modernized and speeded up the sheriff's task immeasurably. Now, with the addition of plane-to-car radio communication, the southwest has the last word in modern police equipment.



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Thousands of Users Say Royce is Better Than Shavers at Three Times the Price.

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NO more blades—no more brushes—no more soaps or lather. Shave the modern Electrical way. Clips tough beards with ease—protects tender skins. Electric Shavers selling as high as \$16.00. Now, superior engineering design makes possible a fine, precision built, life-time Shaver for only \$5.00—fully guaranteed and sent on Ten Day Trial.

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43 East Ohio St., Dept. 76,
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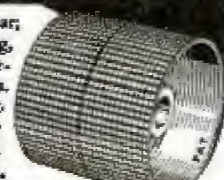
AGENTS Make big money introducing the Royce Dry Shaver to users and dealers in all territories. Seasonal sales and immediate acceptance everywhere on one demonstration. Users say it is superior to any \$15.00 shaver.




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Weight 320 Lbs.

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"How to Run a Lathe"—160 pages, with over 300 illustrations showing every type of work done on a lathe. Catalog No. 46 illustrates, describes and prices the 9-inch lathe in 3', 3 1/2', 4', and 4 1/2' bed lengths, and in 8 different drives. Contains valuable shop information. Use the Coupon.



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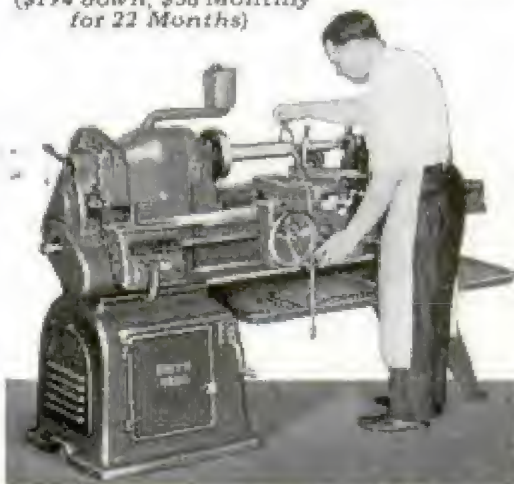
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5 Other Sizes: 9", 11", 13", 15" and 16" Swing. In 3' to 12' Bed Lengths.
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Below is No. 117-C, 16" x 6' Quick Change Gear Undersneath Belt Motor Driven Lathe \$969 with 1 H.P. motor. Weight 2300 lbs.
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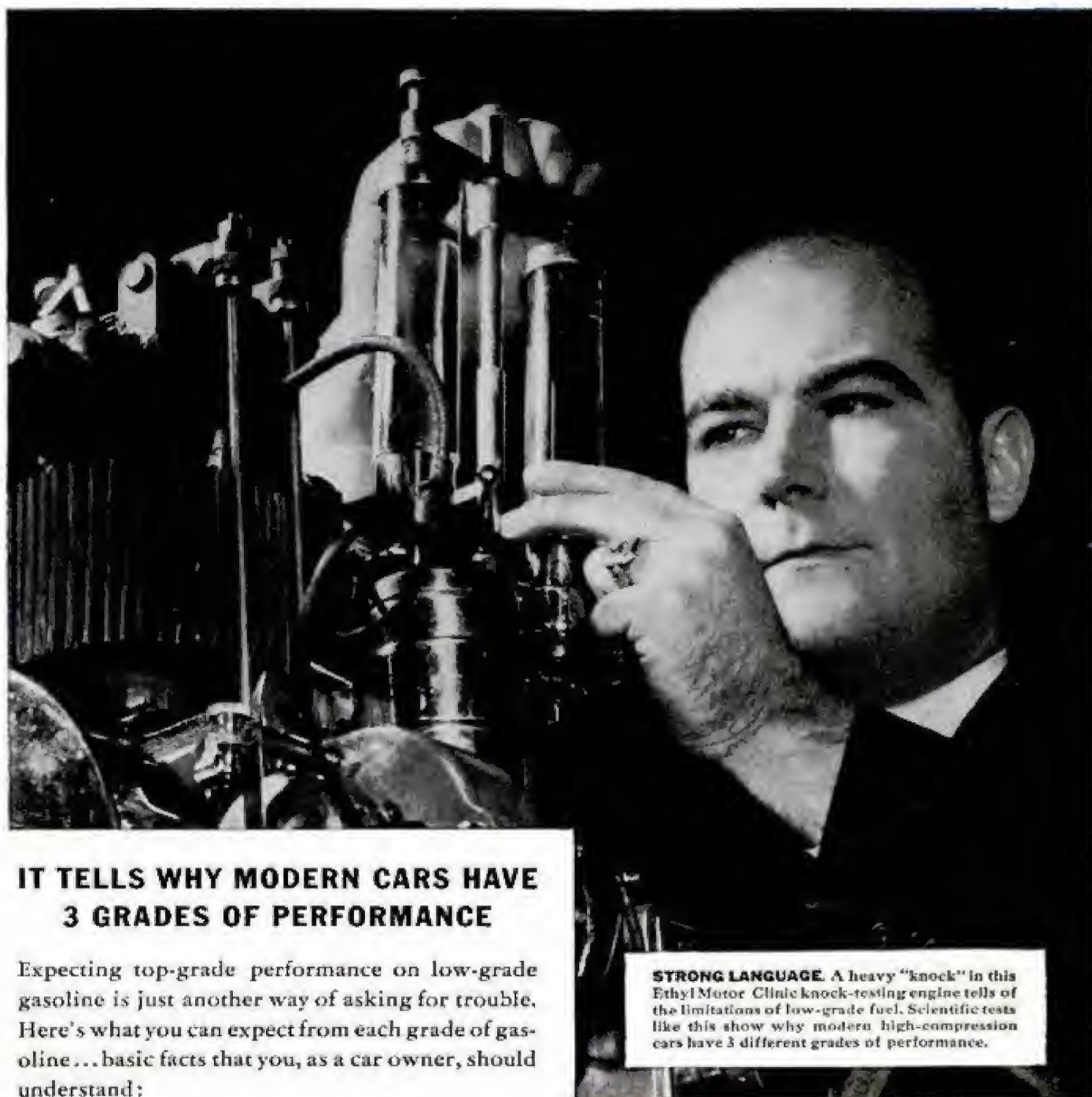


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Expecting top-grade performance on low-grade gasoline is just another way of asking for trouble. Here's what you can expect from each grade of gasoline...basic facts that you, as a car owner, should understand:

STRONG LANGUAGE. A heavy "knock" in this Ethyl Motor Clinic knock-testing engine tells of the limitations of low-grade fuel. Scientific tests like this show why modern high-compression cars have 3 different grades of performance.

Poor performance

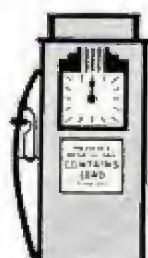
with "low-grade" gasoline



There is no anti-knock fluid (containing tetraethyllead) in "low grade" gasoline. Power is lost because the spark *must* be retarded by your car dealer to prevent "knock" or "ping."

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Most regular gasoline has in it anti-knock fluid (containing tetraethyl lead). The spark can be considerably advanced for more power without "knock" or "ping."

Best performance

with gasoline containing "ETHYL"



Gas "with ETHYL" is highest in all-round quality. It has *enough* anti-knock fluid (containing tetraethyl lead) to let the spark be *fully* advanced for maximum power and economy without "knock" or "ping."

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for a lifetime of
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